April, 1957 TWO SHILLINGS & SIXPENCE

Plastics

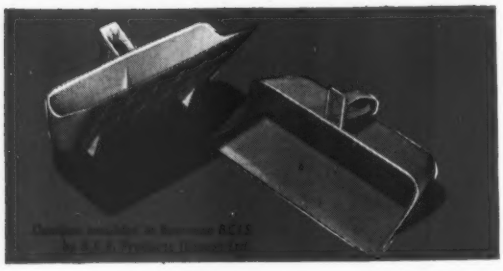
DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

CHEMISTRY DEPT.
PUBLIC LIBRARY

Disc displaying PIRELLI TYRES
uced by The K. R. Webb Company, Painswick, Glos.

tough enough to take the rough—

as well as the smooth of everyday household routine. Bextrene BC 15 toughened polystyrene moulding powder finds an ideal use in this smart, hard-wearing domestic utensil. Bextrene BC 15 is outstandingly tough, moulds well and gives a finish to please the exacting housewife. For industrial mouldings, too, this high-duty material is in great demand.



BEXTRENE | BC15

TOUGHENED POLYSTYRENE MOULDING POWDER

Full technical details on request.

BX PLASTICS LTD. (A SUBSIDIARY OF THE BRITISH XYLONITE CO. LTD.)
HIGHAM STATION AVENUE, LONDON, E.4. TELEPHONE: LARKSWOOD 5511

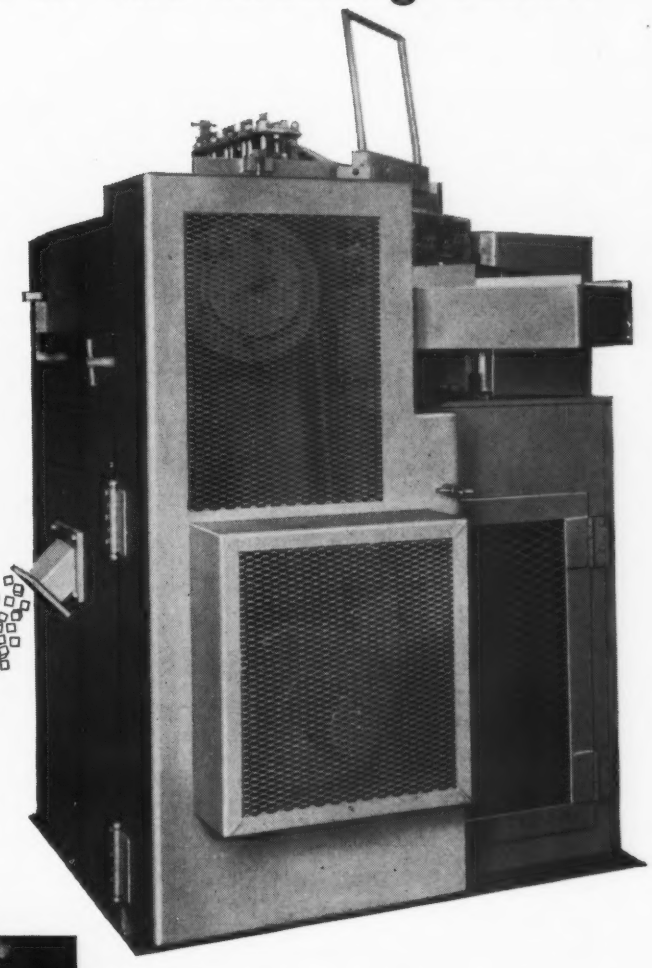
PERFECT CUBES *(NO LONGS)*

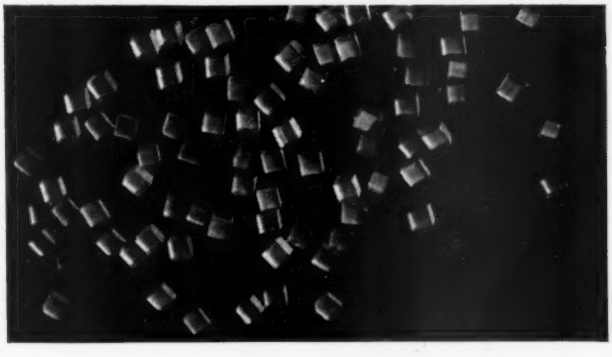
Cut from sheet stock in one shearing action

THE BURTONWOOD CUMBERLAND "STAIR-STEP" DICING MACHINE

Burtonwood-Cumberland "Stair-Step" Dicing Machine offers you a completely new method of dicing plastic materials. Perfect cubes, free from longs, are cut from sheet stock in one shearing action! All sides of the cube are cut cleanly. Cubes or rectangular pellets may be produced in various sizes ($\frac{1}{16}$ in. to $\frac{1}{2}$ in.) by simply changing knives.

This new dicing principle makes it possible to dice the full range of plastic materials, including polyethylene, vinyl, acetate and nylon. Two standard machine sizes accommodate sheets up to 7 ins. or 14 ins. wide. Machines to handle greater widths can be specially built. Write for complete technical details.





We are specialist manufacturers of extrusion screws and liners of all types. Our services include :—

- **Design and manufacture of special screws.**
- **Replacement screws and liners.**
- **The overhaul and redesign of extruding equipment.**

Manufactured under licence from Cumberland Engineering Company, Inc., United States

BURTONWOOD ENGINEERING COMPANY LTD

Head Office & Works : BURTONWOOD, WARRINGTON, LANCASHIRE. Phone: Newton-le-Willows 3311 (10 lines)
London Office & Works: EDGWARE ROAD, THE HYDE, LONDON, N.W.9. Phone: Colindale 4661 (7 lines)

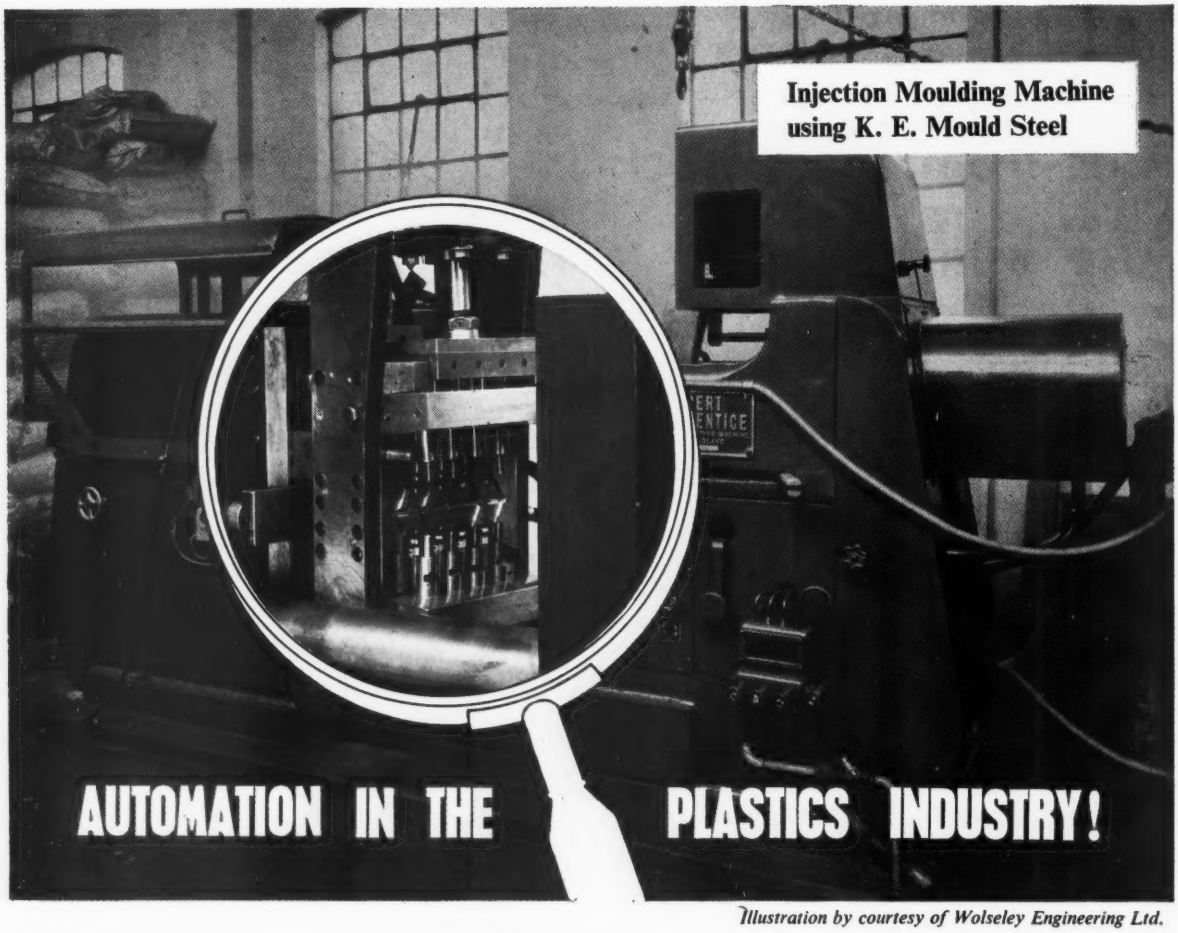


Illustration by courtesy of Wolseley Engineering Ltd.

REPEAT ORDERS ARE USUALLY AUTOMATIC ONCE (KE) HIGH GRADE MOULD STEELS HAVE BEEN USED

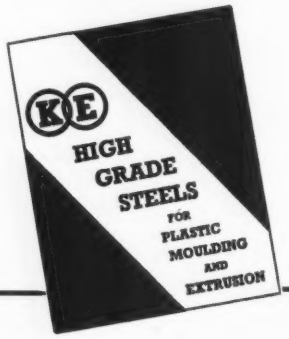
(KE) 355 Special Nickel Chrome Molybdenum Oil or Air Hardening Mould Steel.

(KE) 961 1½% Carbon 12% Chrome High Duty Mould Steel.

(KE) A28 Special Stainless Mould Steel.

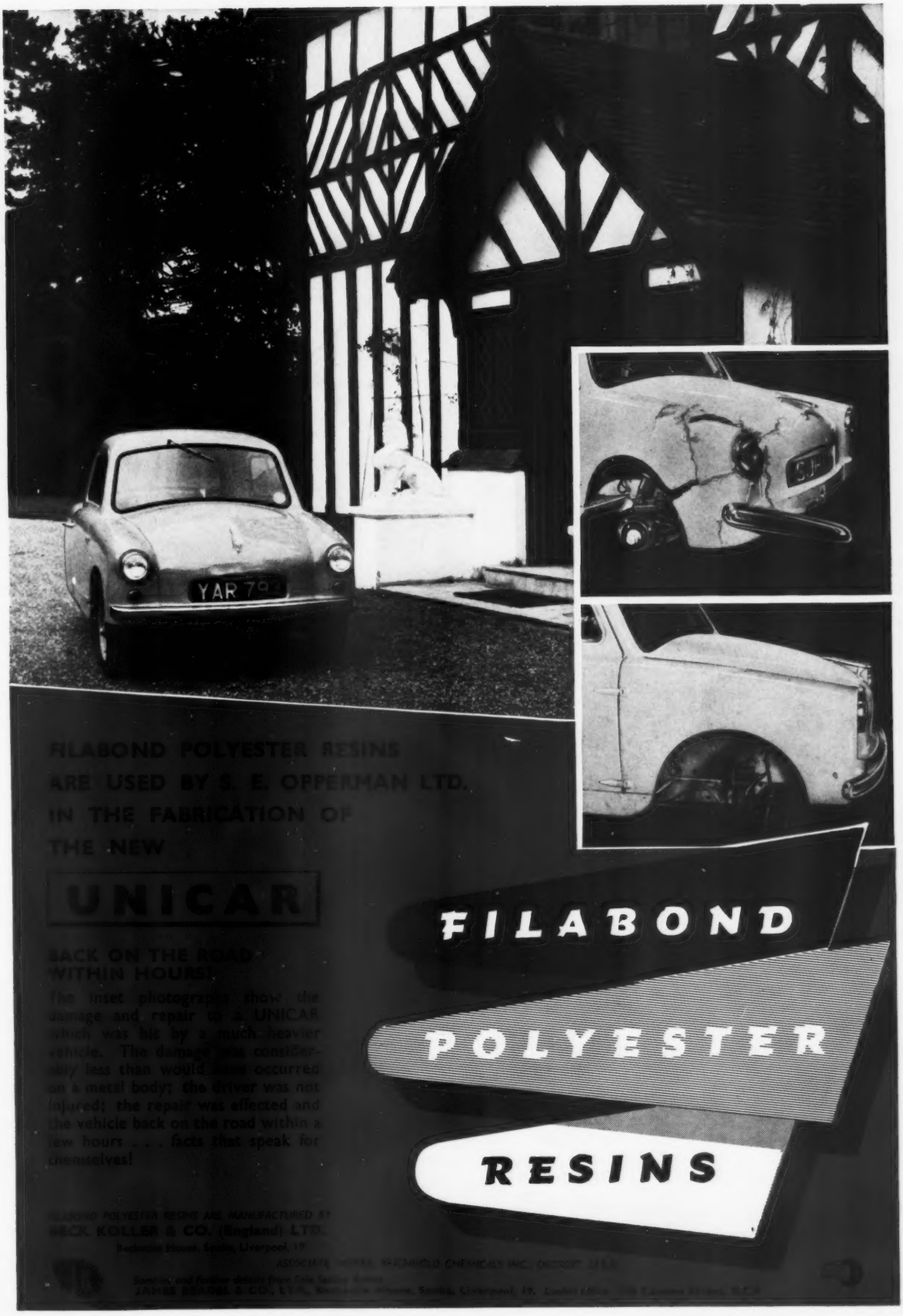
Melted to close limits of analysis. Forged with an adequate reduction of area from the ingot to ensure the maximum amount of grain distortion. Carefully annealed to give optimum machinability and grain refinement. Ultrasonically inspected prior to despatch. These factors and almost one and a half centuries of steel-making experience give our Steels a high degree of regularity and reliability. These Steels have great strength and do not distort under the high pressure of injection moulding.

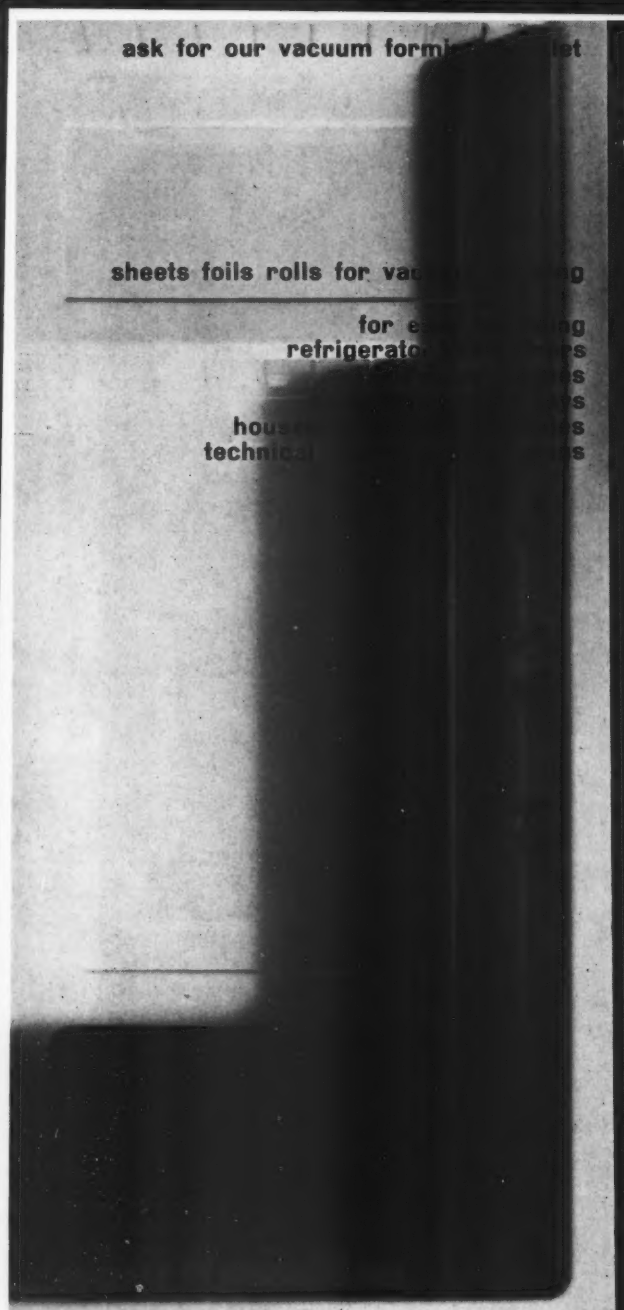
This booklet, giving greater detail, is available free on request.



KAYSER ELLISON & CO. LTD

CARLISLE STEEL WORKS • SHEFFIELD • ESTABLISHED 1825


YAR 79
FILABOND POLYESTER RESINS
ARE USED BY S. E. OPPERMAN LTD.
IN THE FABRICATION OF
THE NEW
UNICAR
BACK ON THE ROAD WITHIN HOURS!
The inset photographs show the damage and repair of a UNICAR which was hit by a much heavier vehicle. The damage was considerably less than would have occurred on a metal body; the driver was not injured; the repair was effected and the vehicle back on the road within a few hours . . . facts that speak for themselves!
FILABOND
POLYESTER
RESINS
FILABOND POLYESTER RESINS ARE MANUFACTURED BY
BECK, KOLLER & CO. (England) LTD.



sicostirol

sic

sic

oplastic materials
for
vacuum forming

sic

VISIT OUR STAND
AT THE MILAN FAIR
APRIL 12-27, 1957

sicovinil

SIC Plastics Ltd.
(Sole U.K. Concessionaires for
Mazzucchelli Celluloide s.p.a.)
12 Whitehall, London, S.W.1
Telephone: Trafalgar 7337

Mazzucchelli Celluloide S.p.A.
Castiglione Olona (Varese) Italy

peter gogel

Induction heating is the efficient method of applying heat at low cost to platens. Heat is developed in the mass of the platen by eddy currents instead of by conduction from resistance elements.

for heat control ± 2°C

...at a price that won't raise your temperature!

BIPEL now offers a complete range of mains frequency induction heating platens and controllers for any press. This is the logical, economical, efficient heating system already proved in practice by BIPEL moulders and now available to all at realistic prices.

The BIPEL Temperature Controller maintains temperature at the required value by supplying, at short intervals, pulses of heat which balance up heat losses over a similar period of time. Used in conjunction with induction heated platens or moulds, it maintains an accurate temperature control within the limits of ±2°C.

PLATEN SIZE		12 INS	14 INS	16 INS	18 INS	20 INS	24 INS	28 INS	30 INS
		30·5 CMS	35·6 CMS	40·7 CMS	45·87 CMS	50·8 CMS	61·0 CMS	71·2 CMS	76·2 CMS
LOADING K.V.A.	50C	1·73	2·35	3·1	4·0	5·0	7·0	9·0	10·5
	60C	1·42	1·96	2·58	3·34	4·17	5·84	7·5	8·75
SUPPLY A.C. ONLY	PHASES	1	1	1	1	1	3	3	3
50/60 CYCLES	VOLTS	220/240	220/240	220/240	220/240	220/240	220 380/420	220 380/420	220 380/420

NON STANDARD VOLTAGES CAN BE SUPPLIED

THE BIPEL SYSTEM OF MAINS FREQUENCY INDUCTION HEATING B·I·P

B·I·P· ENGINEERING LIMITED, Streetly Works, Sutton Coldfield. *Telephone:* Streetly 78411

DO YOU PLAY YOUR LUCK?

Of course you have to play a hunch now and again, life's like that. And good luck to you—so long as you never leave vital things like choosing injection moulding and extrusion materials to chance. There's no excuse for anything but accuracy there—and there's little doubt you'll find the polystyrene that's 100% right for the job in the Kleestron range. Why not take advantage of our experience and resources—and find out? All you have to do is write or phone us: Kleestron Limited, West Halkin House, West Halkin Street, London, S.W.1. Tel: SLOane 0866.

Kleestron

make a comprehensive range of general polystyrenes and impact materials—and will gladly supply technical details, prices, etc.

No Problem too Difficult

be no illusio e have t est technicians and every facility to meet the most exacting specifications for all Industria and Decorative requ nts in L ted Plastics. Quite literally, as Fabricators in Plastics, we serve land, sea and air our pr generalising in everything except Service—where we are Specialist.

Send us your enquiry. We welcome the difficult and rise to the impossible as a challenge to our ingenuity.

IE SPECIALISED DIVISION

G. J. HAWKINS, F.R.S.A.

Insulation Equipments Ltd.

OSWESTRY SHROPSHIRE

TEL: OSWESTRY 790/1 GRAMS: INSULATION

Manufacturers of Plastics Components for all Government Departments, and approved by A.I.D. and Air Registration Board.

Dependable moulding a

- Rapid action H.P.M. straight-line hydraulic mould clamp, quick interchange of moulds with automatic adjustment for thickness.
- Full ejecting pressure secured at any point of the return stroke. Increased daylight and stroke for producing deep parts.
- High speed injection unit increases plasticizing rate, and fast injection plunger speed reduces cycle times.
- Accurate compensating weigh feeders, and an extra timer permit double feeding of material for large capacity shots.
- Dual injection pump for two-speed injection or dual pressure injection, as desired.
- Silent pumps supply hydraulic power for maximum clamping pressure and operation of clamp and injection rams.
- All hydraulic components are readily accessible. A minimum of pipe lines permits easy interchange of valves without interference.

BRITISH

HPM

BUILT

Model 800-H-48 48/64 oz

at lower cost per shot

Step up production with H.P.M. machines — the fastest injection moulders producing thermo-plastic parts at lower cost per shot than any other machines of comparable size.

They are fully automatic "all-hydraulic" machines possessing many outstanding features providing faster cycle times, powerful clamping and easy set-up, accurate material feed and high plasticising capacity.

In addition, they are economical with labour, floor space and material, and are dependable too. The machines range in size to meet every moulding need, and each unit is backed by over seventy years' specialist service.

PLASTICS INJECTION MACHINES

SPECIFICATIONS

	Model 200-H-42	Model 400-H-28	Model 800-H-42
Volume moulded per shot (cu. ins.)	20	34	81
Weight moulded per shot (ozs.)	12	20	48
Approaching or closing stroke (ins.)	15	21	44
Plasticising capacity (lbs./hour)	133	200	360
Rate of injection (cu. ins./second)	14	17.1	40
Size of die platens	28" x 15"	34" x 21"	40" x 30"
Space between tie bars	17" x 10½"	23" x 13"	30½" x 24"
Mould opening stroke	20"	32"	32"
Maximum die space	35"	40"	42"
Maximum die space with spacer	55"	56"	67"
Minimum die space	15"	13"	25"
Minimum die space with spacer	4"	4"	17"
Mould locking force (tons)	200	400	800
Mould locking force with spacer	200	360	710
Capacity of hopper	100	100	200
Power requirements (including water cooling pump) (kW.)	21.6	32.4	57.6
Power supplied	40 h.p. nominal	60 h.p. nominal	100 h.p. and 20 h.p. standby
Shipping weight (approx.)	9.5	12.5	23.5
Overall length and width	10' 6" x 5' 0"	12' 10" x 6' 7"	16' 7" x 7' 1"

All injection capacities specified above are for general purpose polystyrene.
Details of other H.P.M. plastics injection machines on application.

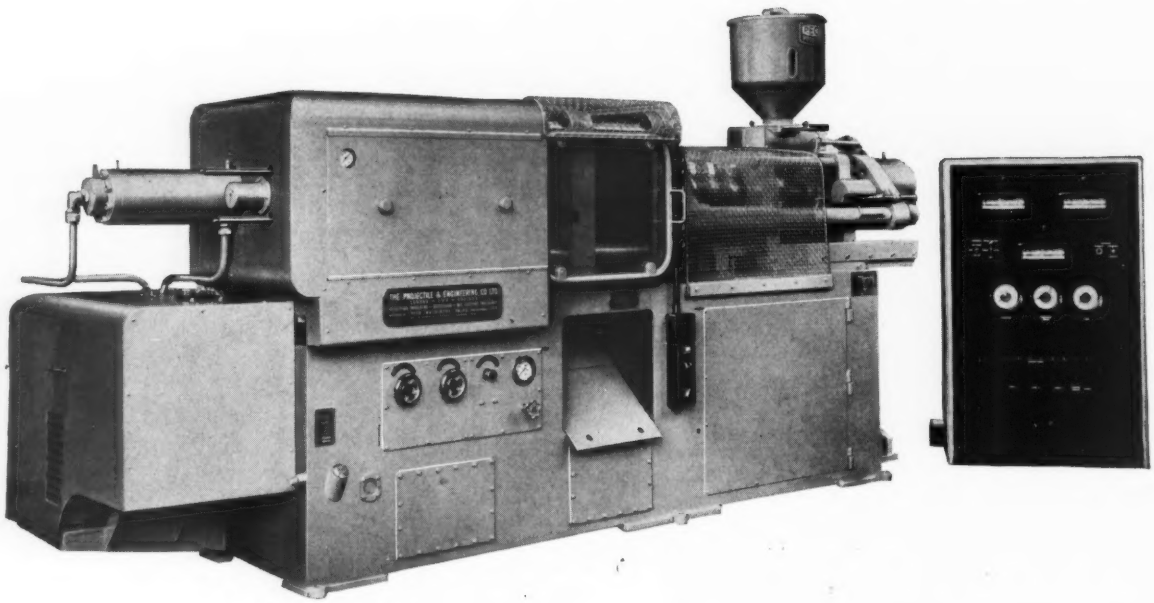
Wickman

W I C K M A N L I M I T E D

FACTORY AND OTHER DIVISION, FLEETCHASETEAD HIGHWAY, COVENTRY

$\frac{1}{2}$ oz.—160 oz. capacity fitted with conventional or pre-plasticising injection units

Injection Moulding Machines



PECO PRODUCTS

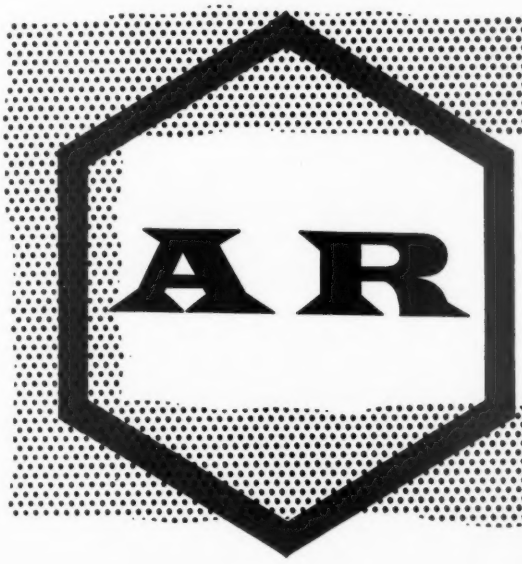
PECO MACHINERY SALES (Westminster) LTD.

28, Victoria Street, London, S.W.1 Telephone : Abbey 1793/4/5

Telegrams : Profectus, Sowest, London. Cables : Pecomatic Sowest, London.

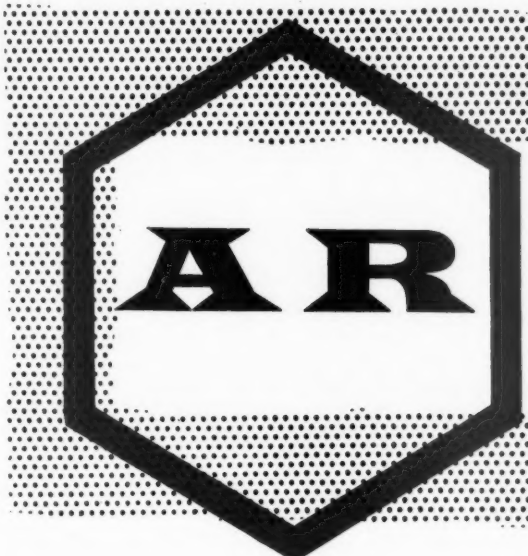
WORKS : THE PROJECTILE & ENGINEERING CO., LTD.

A new and comprehensive service for the REINFORCED PLASTIC MOULDER



POLYESTER COMPOUNDS . . . a separate compound for each technique and end use . . . fully formulated and proved for each specific application . . . ready for use with the sole addition of a hardener . . . pigmented in accordance with customers' requirements.

POLYESTER RESINS . . . a full range of specific grades . . . the right resin, at the lowest cost, for every individual application.



COMPLETE CONSULTANCY SERVICE covering . . . resin development · compound formulation · plant and product design · moulding techniques · prototype manufacture.

The right materials for every purpose — the right advice on every application

ARTRITE RESINS LIMITED *Kingsway Chambers, 44-46 Kingsway, London, W.C.2. HOLborn 3138*

Holding the Balance between

RISING COSTS *and* COMPETITIVE SELLING

*

* If you are planning new lines or find your profits are shrinking consult R. H. COLE for reclaimed plastics

FIGURE COMPOUND
IMPACT POLYSTYRENE
POLYTHENE · POLYSTYRENE
ETC.

R.H.C. Reclamations Limited

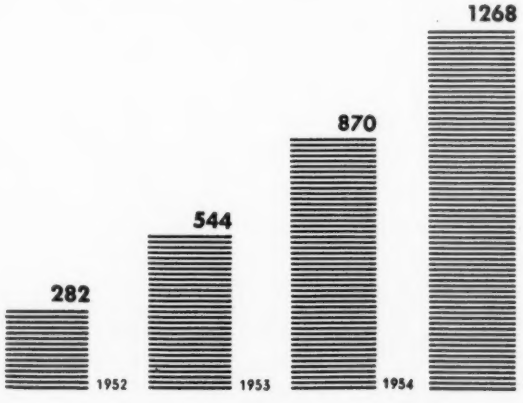
R. H. COLE & COMPANY LTD
2 CAXTON STREET · WESTMINSTER · LONDON · SWI
Telephone : ABBey 3061 (10 lines)
Telegrams : GERATOLE, PHONE, LONDON

JANUARY

1957

THOUSAND

BATTENFELD



We have produced 2,000 Battenfeld fully automatic Injection Moulding Machines since 1949.

This number reflects the efficiency of our modern production plant and equipment. Last year our proportion of deliveries of Injection Moulding Machines was 60% of the total German production and represented an increase of 80% in completed machines.

Our development in collaboration with the producers of raw materials goes to the service of the plastic fabricating industry.

Our advice and experience in injection technology is always available to our customers.

RELIABILITY IN OPERATION, ECONOMY AND AUTOMATIC OPERATION are also the distinguishing characteristics of our Compression Moulding Machines. We have up till now delivered 4,120 of these Machines and are now entering the field for the forming of thermosetting plastics, ceramic powders and sintered metals.

For particulars please apply to our agents:

Ed. Brand Ltd., 9, St. Cross Street, Hatton Garden, London, E.C.1

Telephone: Chancery 4091 (3 lines) Telegrams: Wyrellous, London

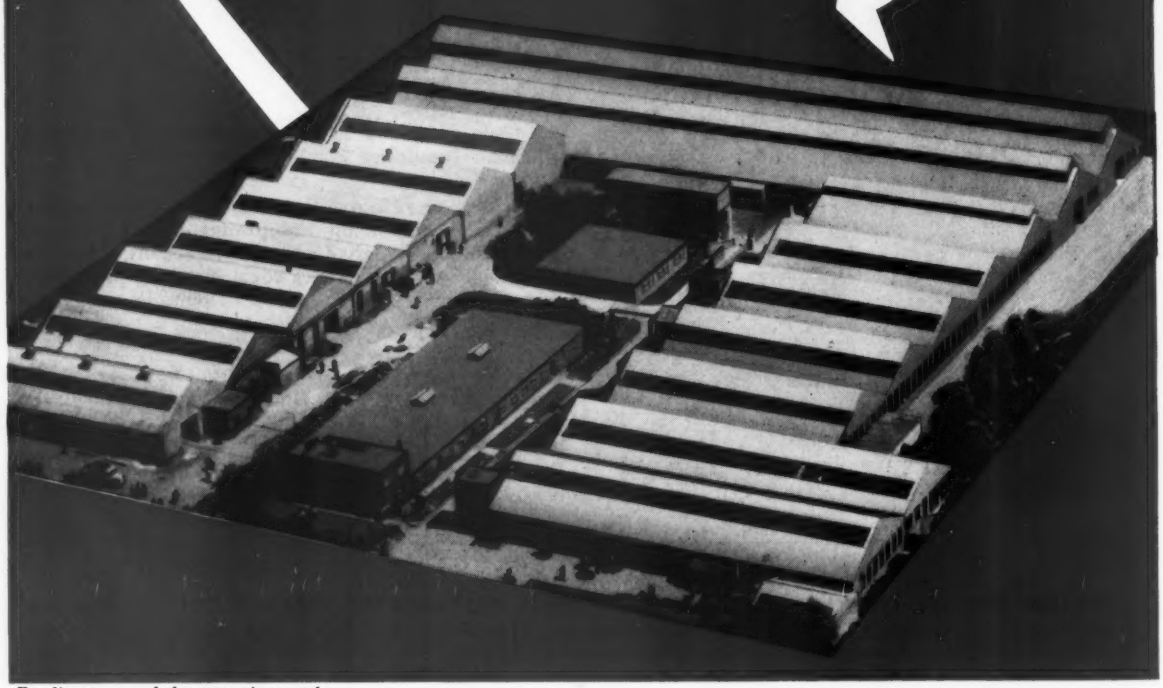
BURTONWOOD - ANDOUART EXTRUSION EQUIPMENT

is now being produced by

BURTONWOOD ENGINEERING CO. LTD.

All types of extrusion machinery for the Cable and Plastics Industry

Extruders · Pay-offs · Capstans · Take-ups · Dicers · Granulators · etc.



For literature and demonstrations apply :

BURTONWOOD ENGINEERING COMPANY LIMITED

Burtonwood, Warrington, Lancashire *Telephone : Newton-le-Willows* 3311 (10 *lines*)

Sole Selling Agents :

WARBRICK (ENGINEERING SPECIALTIES) LTD. Barclays Bank Chambers, Sankey Street, Warrington. Telephone : Warrington 4081

'Sternite'
PHENOLIC MOULDING POWDERS
★ Odourless and Tasteless quality for use in contact with foodstuffs
★ Improved General Purpose Grade S.P.F. 100/16/3 Extra Fast Cure
★ Standard General Purpose Grade S.P.F. 45
★ for
BOTTLE CAPS
The extra fast cure obtained using "Sternite" moulding powders, speeding up production and the exceptionally high quality finish they provide, combine to make "Sternite" pheneolics the best choice for bottle caps and, moreover, advantageous on costs.

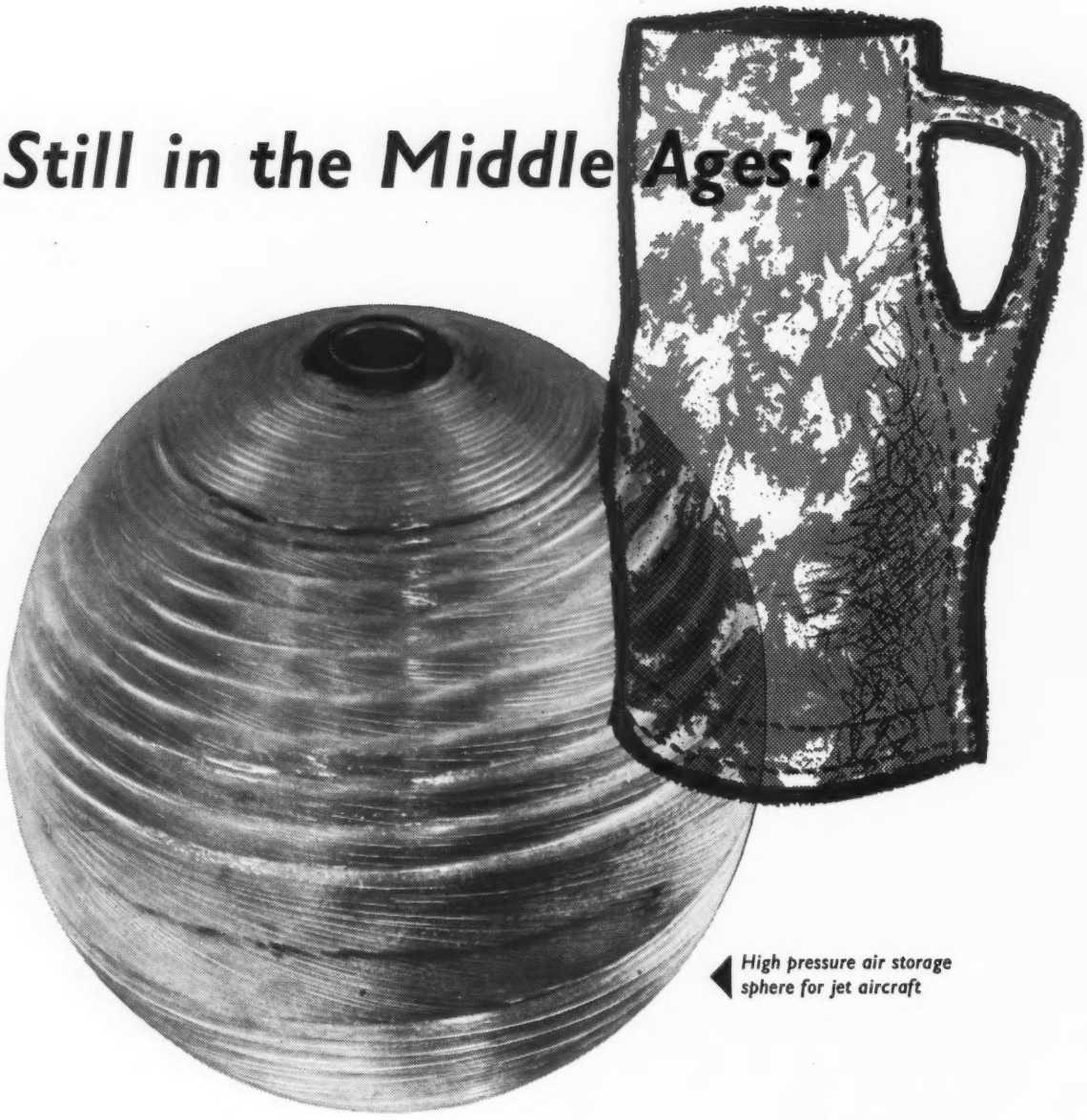
The bottle caps illustrated were moulded by PLASTIC CLOSURES LTD. using "Sternite" phenolic moulding powder.

Sterling Moulding Materials Ltd.

STERLING HOUSE, HEDDON STREET, LONDON, W.1. *Works: Stalybridge, Cheshire.*

S.14 *Phone: Grosvenor 5301/10. Grams: Stermold, Piccy, London. Cables: Stermold, London.*

Still in the Middle Ages?



High pressure air storage sphere for jet aircraft

Or laminating with Epikote Resins?

Epikote Resins, developed by Shell, have opened up new applications for glass-fibre laminates in many fields — tanks, piping, ducts, for instance — where hitherto the use of more conventional materials was the rule. These laminates have high tensile and flexural strengths, excellent fatigue resistance and an all-round chemical resistance. They are light and have a high degree of dimensional stability. Keep up-to-date on Epikote Resins for these and other developments.

SHELL

SHELL CHEMICAL COMPANY LIMITED, Marlborough House, 15/17 Great Marlborough Street, London, W.1.
Tel. GERrard 0666.

"EPIKOTE" *is a Registered Trade Mark.*

Accident or Design?

Shown by courtesy of K.L.G. SPARKING PLUGS LTD., for whom all the above components were made.

It is no accident that well-known progressive concerns, year after year, turn to us for bulk supplies — running into millions of components — of high quality, reasonably priced, Plastic mouldings — delivered on, *or before*, time.

You, too, will do the same when you know us.

METROPOLITAN PLASTICS LTD

CERTIFIED ZINC ALLOY ZAMCA DIE CASTERS

GLENVILLE GROVE · DEPTFORD · LONDON SE8 *Phone* **TIDeway 1172-3**

B

Completely New!

ETHER LIMITED

TRANSITROL

REGD

INDICATING TEMPERATURE-CONTROLLERS
SERIES 900

PATENT
BRITISH-MADE
THROUGHOUT

NO
THERMIONIC VALVES
★
NO WARM-UP
TIME
★
PRECISION CONTROL
★
$8\frac{3}{4}$" x $4\frac{3}{8}$"
PANEL CUT-OUT

★

Type 991 Anticipatory or
On/Off **CONTROLLER**
£40-15-0

★

Type 992 Proportioning
(stepless) **CONTROLLER**
(including pilot amplifier and saturable reactor)
from £85-0-0

★

Immediate Delivery

This unique wide-range direct-deflection instrument indicates and controls temperature accurately . . . it costs considerably less than conventional electronic controllers . . . and, furthermore, outclasses all electronic controllers in accuracy, simplicity and reliability . . . fully described in our new TRANSITROL data-leaflet available on request.

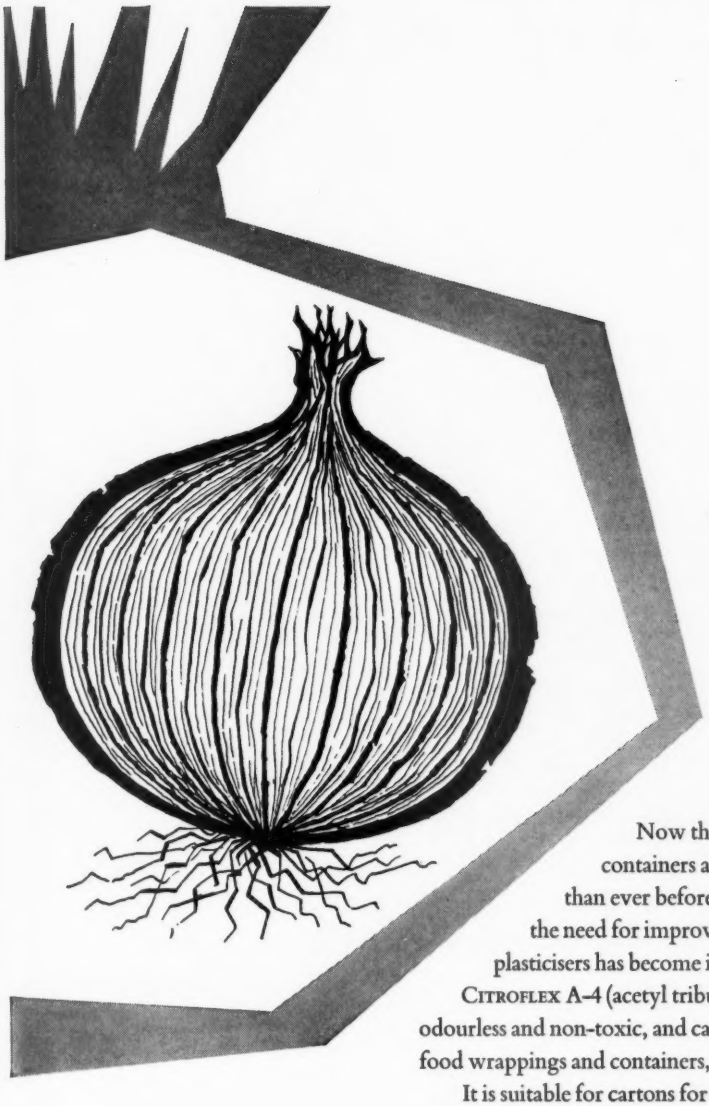
ENQUIRIES, SALES AND SERVICE:

MIDLAND COUNTIES: ETHER LTD.
Tyburn Road, Erdington, Birmingham, 24 : East 0276/7/8

SOUTHERN COUNTIES: ETHER LTD.
Caxton Way, Stevenage, Herts: Stevenage 780/1/2

NORTHERN COUNTIES: V. L. FARTHING & CO. LTD.
329 Tower Building, Water Street, Liverpool, 3 : Central 9626
Waterloo Buildings, 10 Piccadilly, Manchester, 1 : Central 3539

ETHER LIMITED



Safe . . . and odourless

Now that plastic wrappings and containers are being used to a greater extent than ever before in the packaging of foodstuffs, the need for improved, odourless and non-toxic plasticisers has become increasingly important.

CITROFLEX A-4 (acetyl tributyl citrate) is completely odourless and non-toxic, and can be used in the manufacture of all plastic food wrappings and containers, including those intended for fatty foods.

It is suitable for cartons for dairy produce, bottle caps for soft drinks, seals for preserving jars, and many other applications.

CITROFLEX A-4

PFIZER CITROFLEX*

PFIZER LTD · FOLKESTONE · KENT

Distributors: Kingsley & Keith Ltd., 110-112, Victoria Street, London, S.W.1. *Phone:* TATe Gallery 4092

* *Trade Mark of Chas. Pfizer & Co., Inc.*

Pfizer

CRYSTIC AND MARCO
Pioneer Polyesters

Scott Bader have been manufacturing polyester resins for 10 years, and during this time an unrivalled reputation has been achieved for consistency, prompt delivery and sound technical service.

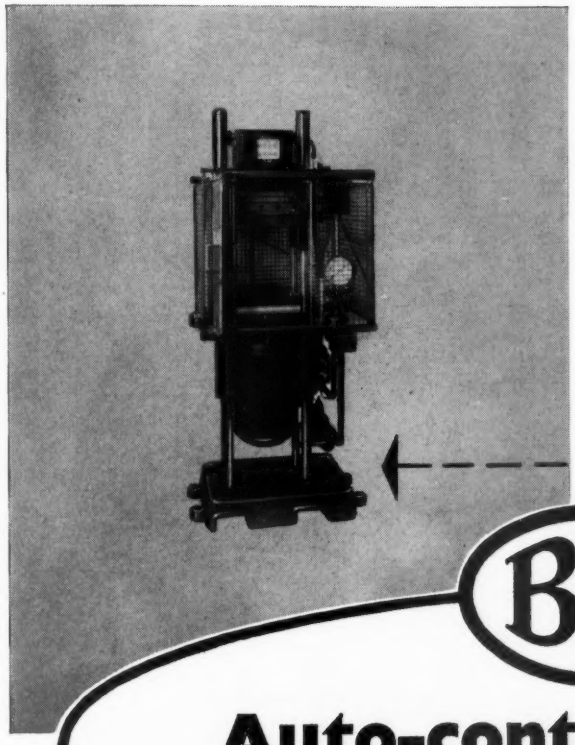
Crystic 189	for boat construction. The finest polyester available.
Crystic 191	the most widely used polyester for general moulding work, commercial vehicles, caravans, etc.
Crystic 195	for roof sheeting having maximum clarity.
Crystic 300	the first, and still the best, self extinguishing resin.
Marco Resin SB. 28D	the very latest heat resistant polyester, with no processing limitations.

Over 50 other **Scott Bader** polyester resins and ancillary products are also available.

from the pioneer spirit . . .
flows friendly and efficient service

SCOTT BADER & CO LTD
POLYESTER DIVISION

WOLLASTON, WELLINGBOROUGH, NORTHANTS. **Tel.: Wollaston 262 (3 lines)**
London Office—**109 KINGSWAY, W.C.2. Tel.: Holborn 3691 (3 lines)**

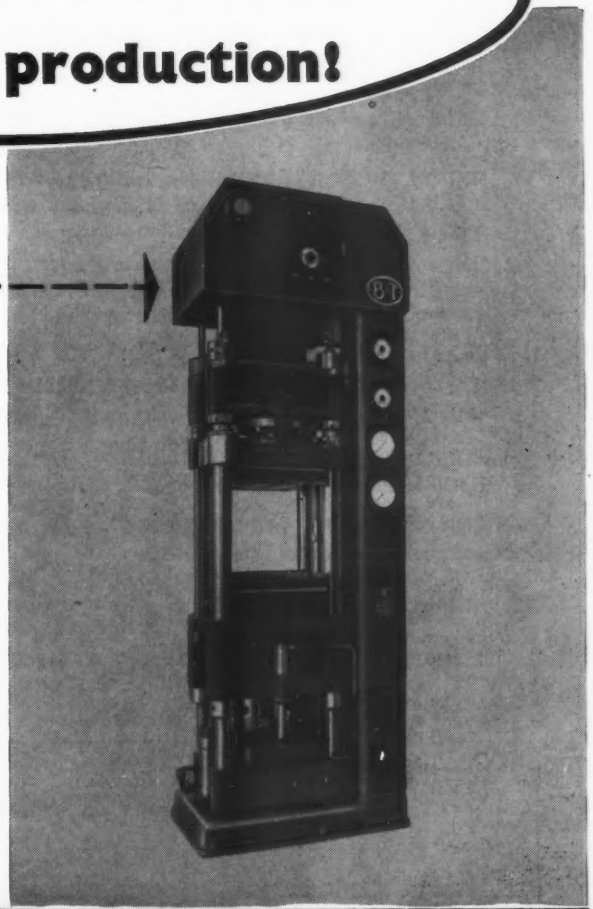


No. 501 Type W/1

25 Ton Fast Cycling Upstroking Press, fitted with "easiest to set" controller for all compression cycles. Operated by push-button or by closing the operator guard.

B&T

Auto-control Presses for quality production!



No. 536 Type U/1

150/35 Ton Universal Compression and Transfer Press with Auto Cycle control to repeat any thermosetting moulding cycle including "breathing" and "dwell," automatically. Push-button start and automatic guard operation.

We shall be pleased to send full details on request.

BRADLEY & TURTON LTD.

Head Office and Works:

CALDWALL WORKS, KIDDERMINSTER

Telegrams: "WHEELS" KIDDERMINSTER. Telephone: 2217/8

Birmingham Office:
13 Soho Road, Handsworth, Birmingham, 20 *Telephone: Northern 2519*

THE LEADING MANUFACTURERS OF COMPRESSION MOULDING EQUIPMENT

EXCITING PROMISE OF DRY POWDER FULFILLED BY NU-SWIFT!

HOW NU-SWIFT DRY POWDER KILLS DANGEROUS FIRES

Released from a sealed pressure charge, the finely ground powder bursts out in a fan-shaped cloud, smothering and blanketing the fire. The fine cloud also gives the fire fighter complete protection against the intense heat of a liquid fire, allowing him *to get within effective range of the blaze.*

DRAWBACKS HITHERTO ASSOCIATED WITH DRY POWDER PRINCIPLE NOW ELIMINATED

WE MAKE OUR OWN POWDER It is carefully prepared, ground, sieved, and mixed in our own £30,000 powder mill. Special treatment during manufacturing process avoids any chance of coagulation through static electricity.

No ingredients liable to bacteriological decay are used in its manufacture.

EFFICIENT EXTINGUISHER DESIGN Nu-Swift dry powder is held in sealed pressure charges—so it cannot cake, pack, or coagulate because of humidity.

Only negligible maintenance is necessary: inspection is simple—the tell-tale gauge on the container indicates whether the charge is unused and under pressure.

NU-SWIFT DRY POWDER IS NON-TOXIC; NON-CONDUCTIVE; NON-CORROSIVE; NON-ABRASIVE; AND FROST-PROOF DOWN TO —40°C.

EXTINGUISHER MODEL 1604: £10.10.0.
FOC Ref. No. 104/8. Spare charges (No. 64) 95/-

SEND OR PHONE FOR BOOKLET No. 364 — better still, mail your order—and see for yourself!

NU-SWIFT

THE WORLD'S FASTEST AND MOST RELIABLE FIRE FIGHTING EQUIPMENT

NU-SWIFT LTD., 25 PICCADILLY, LONDON, W.1. Tel: REGent 5724
FACTORY & HEAD OFFICE: ELLAND, YORKSHIRE. Tel: Elland 2852

To Nu-Swift Ltd., Dept. P.L., 25 Piccadilly, London, W.1.
Please let me have your Dry Powder extinguisher booklet No. 364.

NAME .....

ADDRESS .....

THE NU-SWIFT DRY POWDER EXTINGUISHER MODEL 1604

Astounding new Dry Powder extinguisher which kills these fires IN SECONDS:

CLASS 'B' FIRES

*All accessible inflammable liquid fires, including alcohol, petrol, organic solvents of every kind, oils and asphalts.

CLASS 'C' FIRES

*All electrical fires, and fires in motor vehicles, electronic equipment, etc.

Bulk supplies of ISOCYANATES and POLYESTERS available now from . . . ICI

FLEXIBLE FOAMS *Made in varying densities and pore sizes for industrial insulation, upholstery and many other applications. Low inflammability.*

TEXTILE COATINGS *For rainwear and tarpaulin proofings resistant to abrasion, flexing and dry-cleaning, and for electrical insulation with excellent heat-ageing properties.*

PRINTERS' ROLLERS *Simple to make, the rollers have long life, good ink-spreading characteristics and are easily cleaned.*

SURFACE COATINGS *On wood, metals, rubber, leather, concrete, etc. Resistant to chemicals, solvents, humidity and abrasion.*

RIGID FOAMS *Strong, light, and easily foamed in the space to be filled. Strongly recommended for the thermal insulation of houses and ships, and in aircraft construction.*

POTTING COMPOUNDS *Providing excellent electrical insulation, and protection against mechanical and thermal shocks.*

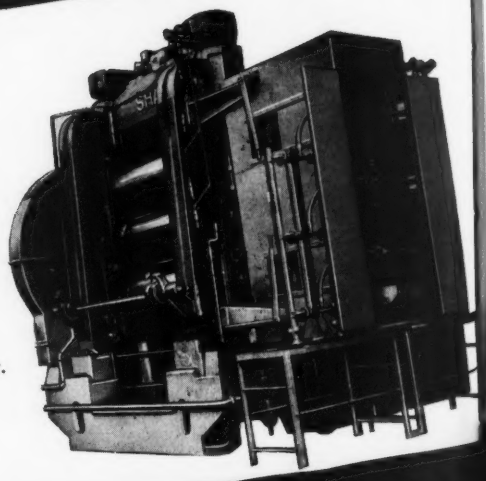
Full information on request :

D.862 IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON SW1

SHAW

CALENDER

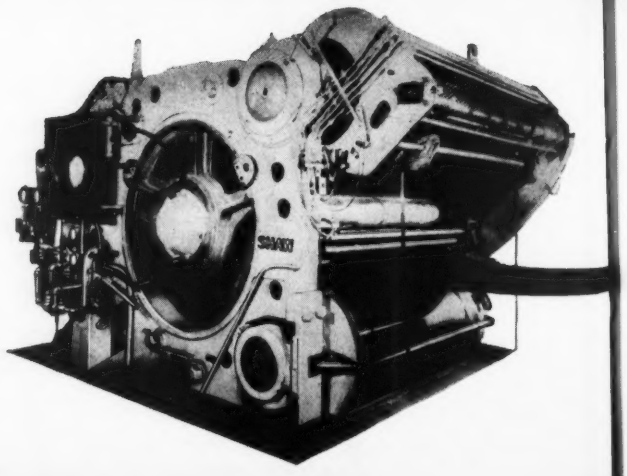
One of a range of modern calenders designed for maximum efficiency with absolute economy. Press-button control. Individual drive can be supplied to each roller.



quality engineering for quantity production

ROTOCURE

For the continuous bonding of plastics for the production of belting, flooring, matting and similar flat products.



FRANCIS SHAW & CO LTD MANCHESTER 11 ENGLAND

PHONE EAST 1415/8 GRAMS CALENDER MANCHESTER TELEX 66-357

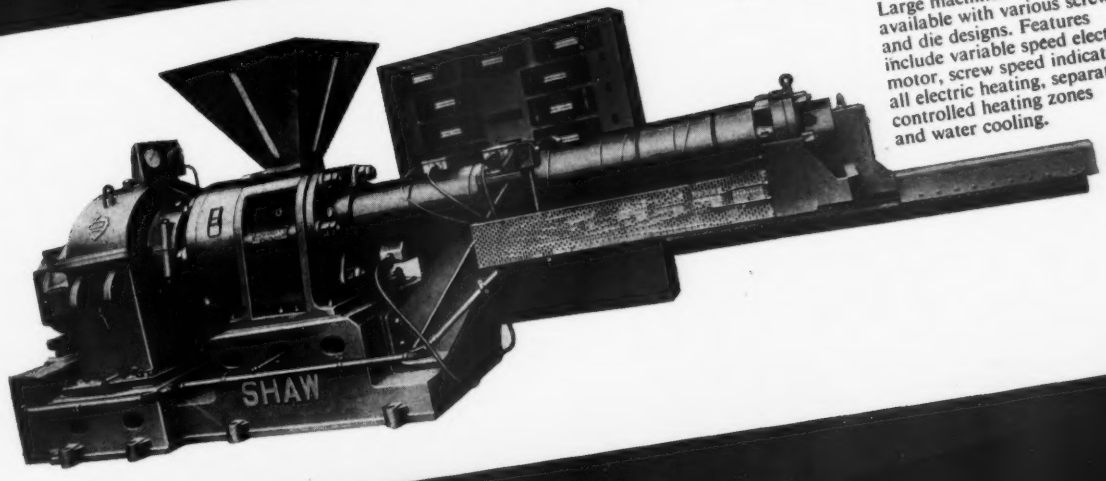
LONDON OFFICE: TERMINAL HOUSE GROSVENOR GARDENS LONDON SW1

PHONE SLOANE 0675/6 TELEX 2-2250 GRAMS VIBRATE LONDON TELEX

PLASTICS PLANT

PLASTIC EXTRUDER

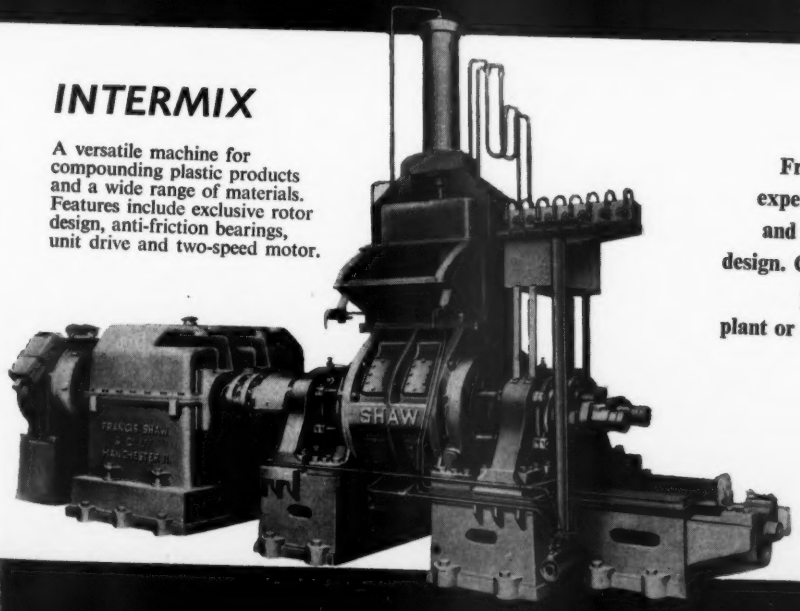
Large machines of this type are available with various screw and die designs. Features include variable speed electric motor, screw speed indicator, all electric heating, separately controlled heating zones and water cooling.



from machines to complete layouts

INTERMIX

A versatile machine for compounding plastic products and a wide range of materials. Features include exclusive rotor design, anti-friction bearings, unit drive and two-speed motor.



Francis Shaw offer the experience of over 70 years and plant of the most advanced design. Our services include planning and layout of new plant or modernisation projects.

FRANCIS SHAW (CANADA) LTD GRAHAMS LANE BURLINGTON ONTARIO CANADA

TELEPHONE: NELSON 4-2350 TELEGRAMS: CALENDER BURLINGTON ONTARIO

FAWCETT FINNEY LIMITED

PRESENT the

STEWART BOLLING

Spiral-Flow

INTENSIVE MIXERS

for RUBBER and PLASTICS

Illustrated is the No. 4 Bolling Spiral - Flow Intensive Mixer with a 500 h.p. compound drive (Manufactured under license by Fawcett-Finney Ltd. Patents Pending)

Designed and built to meet today's heightened demands for production BOLLING Spiral-Flow INTENSIVE MIXERS give high-speed uniform mixing and increased capacity with less power consumption and lower maintenance costs. BOLLING MIXERS excel on Polythene and on Butyl rubber where much higher temperatures than normal are required and temperatures up to 400°F. can be catered for employing flood lubrication. Chamber capacities from 200 to 16,000 cu. ins. are available to handle 4 to 500 lb. batches. Let us know **YOUR** requirements — we shall be pleased to advise you and supply further details.

ADVANTAGES OF THE STEWART BOLLING INTENSIVE MIXERS

1 **Less power consumption from anti-friction bearings and full circle end flanges of the rotors.**

2 **The balanced proportions (diameter to length of flute) and the unique design of the helixes gives faster mixing and dispersion.**

3 **Longer effective life.**

4 **Lower maintenance costs.**

5 **ACCESSIBILITY to a remarkable degree.**

FAWCETT-FINNEY LIMITED

BERKLEY STREET . BIRMINGHAM 1

Telephone : MIDland 3795/6/7

Cables: 'Finhyd' Birmingham 1

In association with Fawcett Preston & Co. Ltd., Bromborough, Cheshire and Finney Presses Ltd., Birmingham, 1.

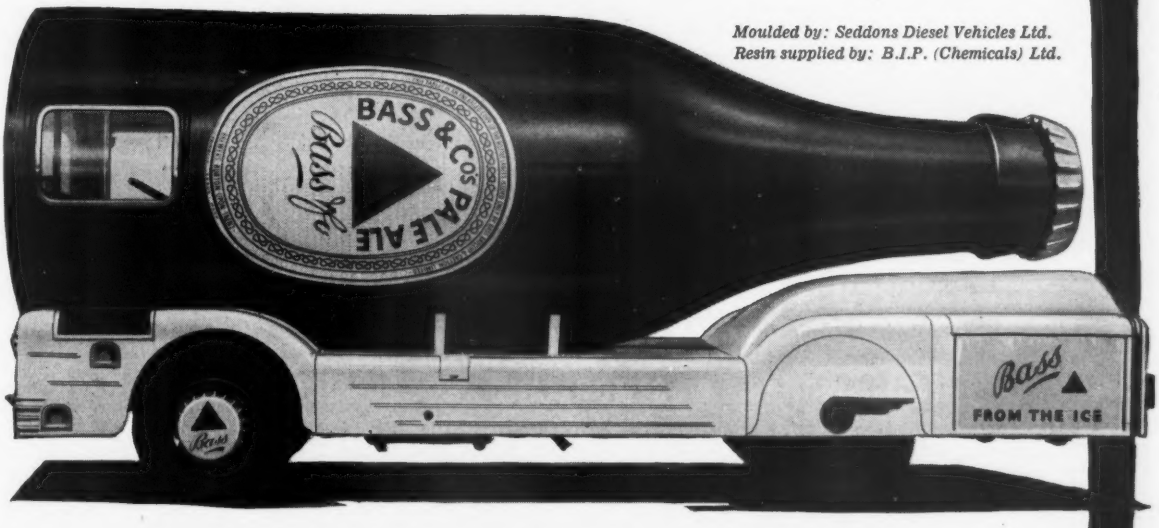
FF/130

FIBREGLASS
TRADE MARK

the backbone of Reinforced Plastics

This 20 ft. bottle is made of Fibreglass reinforced plastics.
Can you imagine having to tackle a job of this kind
in any other material!
The bottle was moulded in halves, $\frac{3}{16}$" thick. It consists of
three layers of Fibreglass chopped strand mat impregnated with
polyester resin. The halves were joined top and bottom by
flanging the edges and bonding Fibreglass cloth over the joint.
The result is a body that cannot corrode, doesn't drum,
is impossible to dent and will never need painting.
To give a new twist to an old slogan: you can't beat a bottle
of Bass—when the bottle is moulded in Fibreglass!

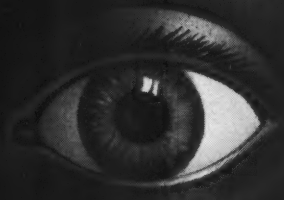
Moulded by: Seddons Diesel Vehicles Ltd.
Resin supplied by: B.I.P. (Chemicals) Ltd.



Fibreglass have an F.R.P. advisory service which is expert, confidential and free.

FIBREGLASS LIMITED, ST. HELENS, LANCS · ST. HELENS 4224

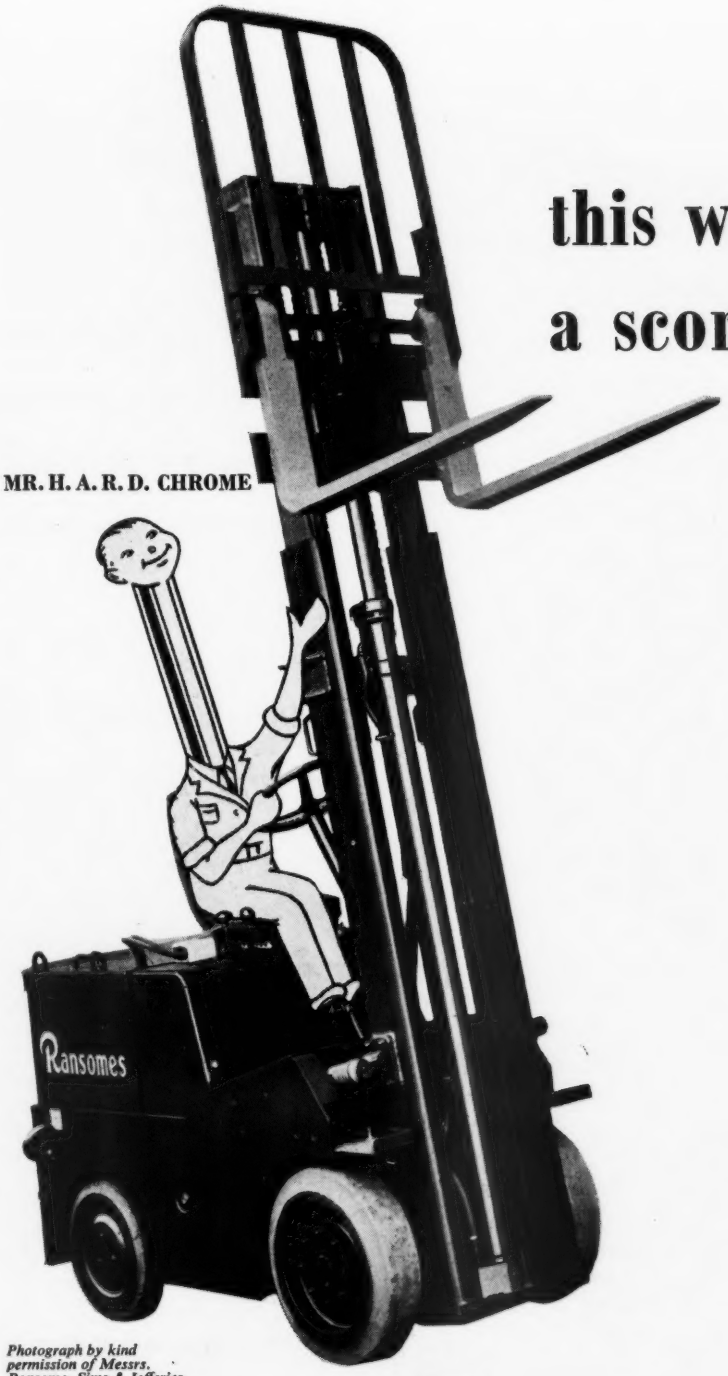
At first it may look impossible –



BUT THROUGH THE EYE
OF AN EXPERT IT MAY
BECOME POSSIBLE

P & B
INJECTION
MOULDING

PUNFIELD & BARSTOW
(MOULDINGS) LTD.
BASIL WORKS, WESTMORELAND RD. LONDON, N.W.9
Tel.: COLINDALE 2266-7-8 · *Cables:* PUNFIBARS, HYDE, LONDON



MR. H. A. R. D. CHROME

this was a scoring problem?

Toolchrome solved it

Ransome, Sims & Jefferies Ltd., renowned the world over for quality fork lift trucks, use hydraulic cylinders and rams, deposited with Hard Chrome and polished by the Toolchrome Process of Electro-Deposition, to prevent scoring and to prolong the life of packings.

All "Hydraulics" Users have similar problems—Toolchrome have the answers..

Photograph by kind permission of Messrs. Ransome, Sims & Jefferies Ipswich.

The "TOOLCHROME PROCESS" is approved by the A.I.D. & A.R.B. and is used in the following industries
CABLE · FOIL · DAIRY
AERONAUTICAL · ELECTRONICS
& ATOMIC · HYDRAULICS
MARINE · AUTOMOBILE
PENCILS · WALLPAPER
TEXTILES Etc.

Toolchrome Ltd

SOUTH GREEN WORKS, BILLERICAY, ESSEX
Telephone: BILLERICAY 2
ANNIS WORKS, ANNIS ROAD, LONDON, E.9
Telephone: AMHerst 2735

The Hard Chrome Depositors with the Engineering background

machinery from IPL

The Eck Mixtruder

The new triple-screw Universal Compounder for the continuous production of Thermoplastic Compounds

combining all the advantages of twin and single screw Extruders

from the manufacturers of the well-known ECK Calenders for Rubber, Plastics & Linoleum

Outputs from 200 to 2,000lb. per hour

Supplied with British Temperature Controls & Motor-Drive

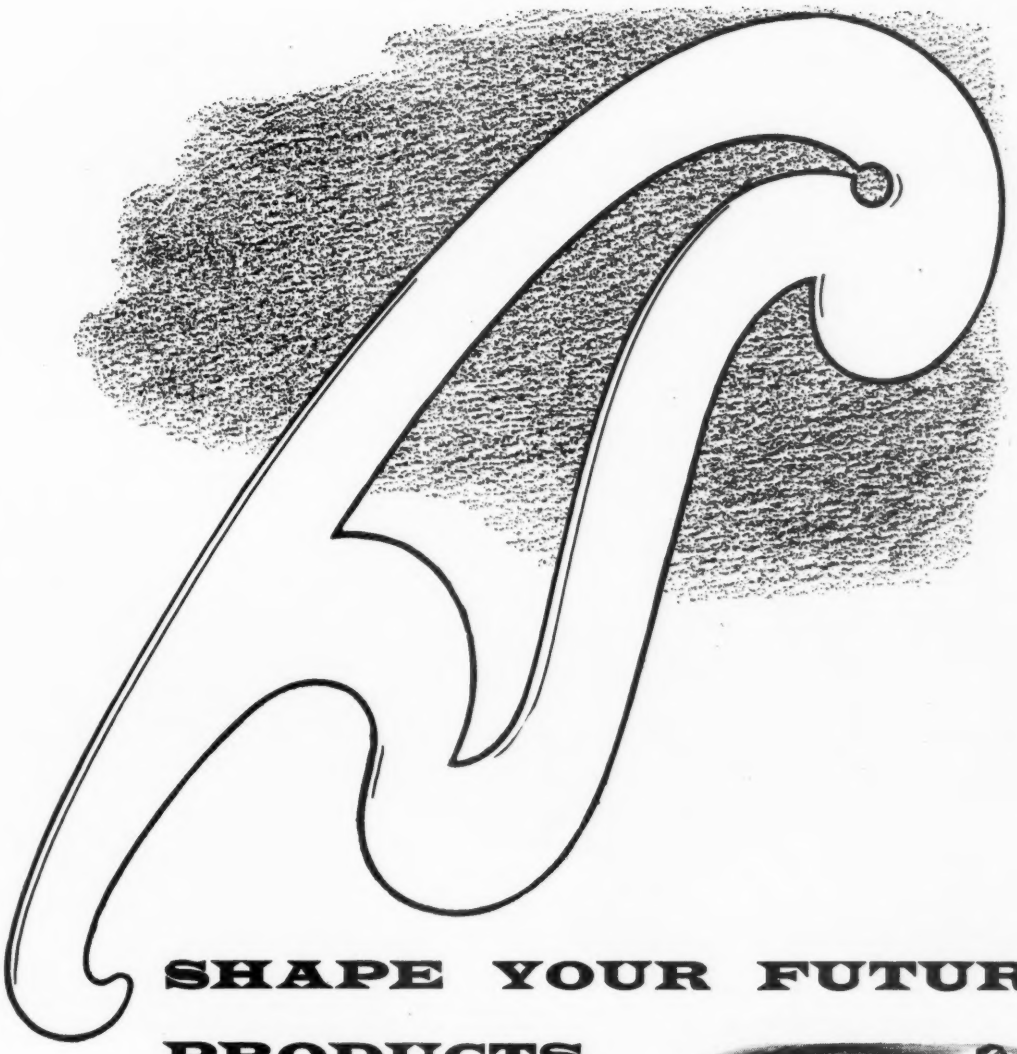
The range of machinery from I.P.L. includes:

Girovinyle Granulators
Pourtier Spark Testers
Fluidflow Screener Conveyors
Condux Granulators
Bandera Extruders
Decombe Coilers
Sommer Injection Presses
Hartig Extruders

For full details and demonstration please contact

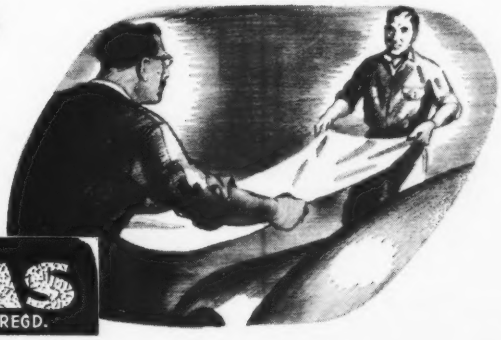
IPL **INDUSTRIAL PLASTICS LIMITED**

LONDON & EXPORT OFFICE 93 Regent Street, London W.1
Telephone: REGent 3146/9 Cables: Ipla London
MACHINERY SHOWROOMS 93 Harrow Road, London W.2



SHAPE YOUR FUTURE

PRODUCTS *with* . . .



DURAGLAS REGD.

GLASS FIBRE REINFORCEMENTS FOR PLASTICS

Write for details of the range to:

TURNER BROTHERS ASBESTOS CO. LTD. ROCHDALE ENGLAND

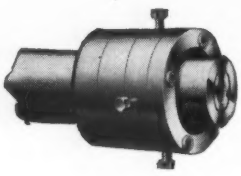
A MEMBER OF THE TURNER & NEWALL ORGANISATION

dm TA 7

GENERAL PLASTIC EXTRUDERS

$1\frac{1}{2}$", $2\frac{1}{2}$", $3\frac{1}{2}$", $4\frac{1}{2}$" Sizes

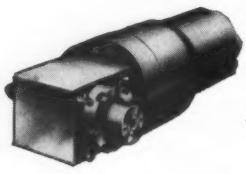
$1\frac{1}{2}$" plastic extruder with tubing die-head.



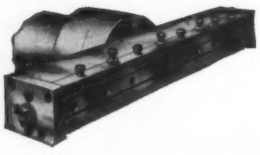
Tubing die-heads

Lay-flat heads

Full range of auxiliary equipment available



Cross-heads for cables



Sheeting die-heads

- ★ **British designed and built**
- ★ **Continuous rating with adequate power**
- ★ **High output rates**
- ★ **Smooth vibrationless running**
- ★ **Screws and die-heads to suit duty**
- ★ **Easy cleaning**
- ★ **Full instrumentation**
- ★ **Externally mounted variable-speed drive**
- ★ **Separate temperature control panel**

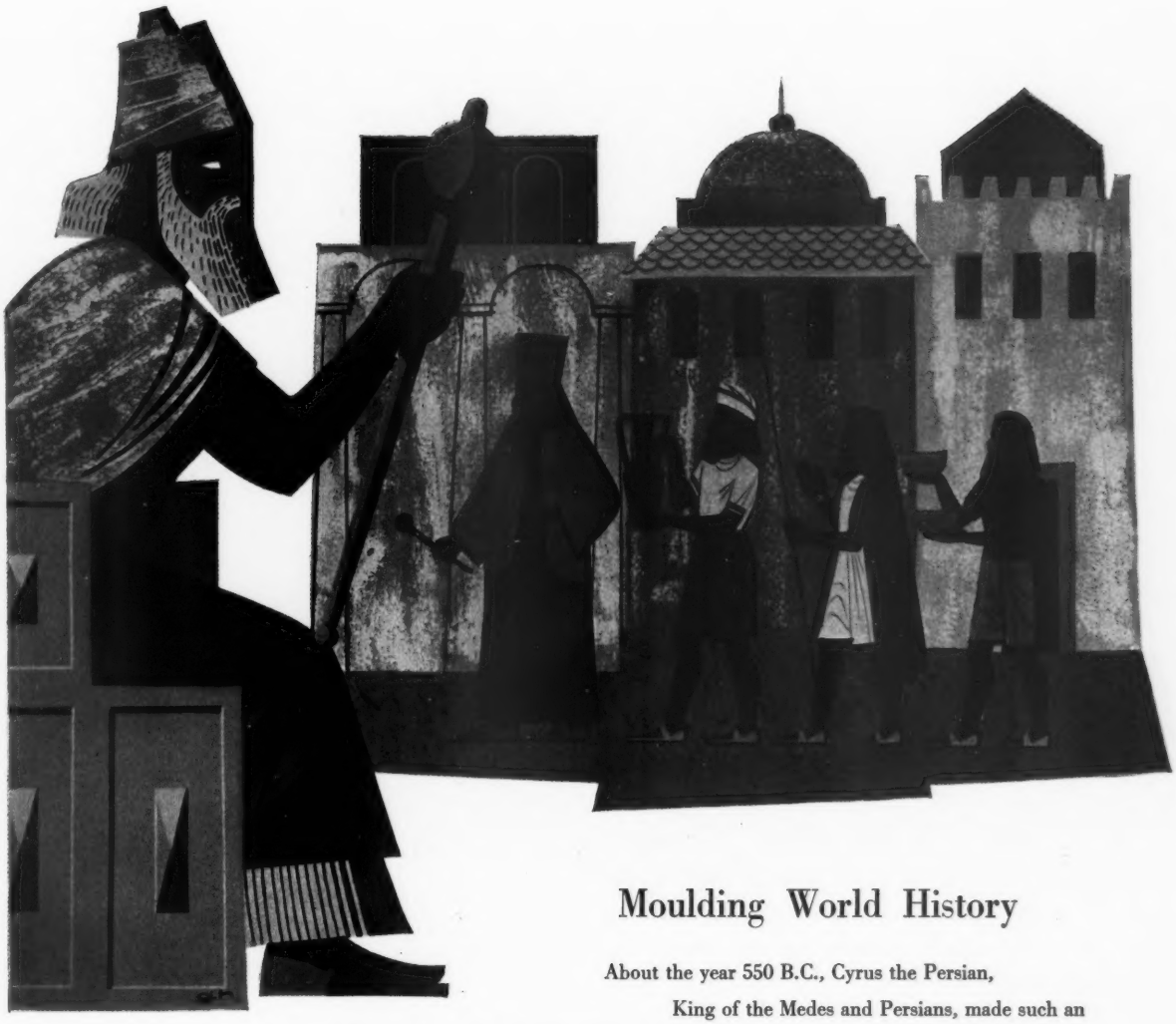
Die-head assemblies for piping, sheathing, sheeting, stranding, belting and lay-flat.

Our technicians will gladly advise you on your plastic and rubber extrusion problems.

GENERAL ENGINEERING

CO. (RADCLIFFE) LTD.

Station Works, Bury Road, Radcliffe, Lancs, England. *Telephone:* Radcliffe 2291 (3 lines). *Telegrams:* "General" Radcliffe.
London Office: 9 Victoria Street, S.W.1. *Telephones and Telegrams:* ABBey 5278.
Birmingham Office: Guildhall Building, Navigation Street, Birmingham, 2. *Telephone:* MIDland 7797.
Represented in Australia, Austria, Denmark, France, Norway, Sweden, Yugoslavia.



Moulding World History

About the year 550 B.C., Cyrus the Persian, King of the Medes and Persians, made such an impression upon his contemporaries because most of his conquests took the form of liberations. He was regarded as a great leader and humanist. During his rise to greatness there were no massacres, flayings or deportations, which resulted in many of his newly-acquired subjects paying homage to this great King.

As indeed today, our customers pay tribute to the NESTORITE Service which at all times is available for the supply of SPECIAL POWDERS for SPECIFIC PURPOSES.

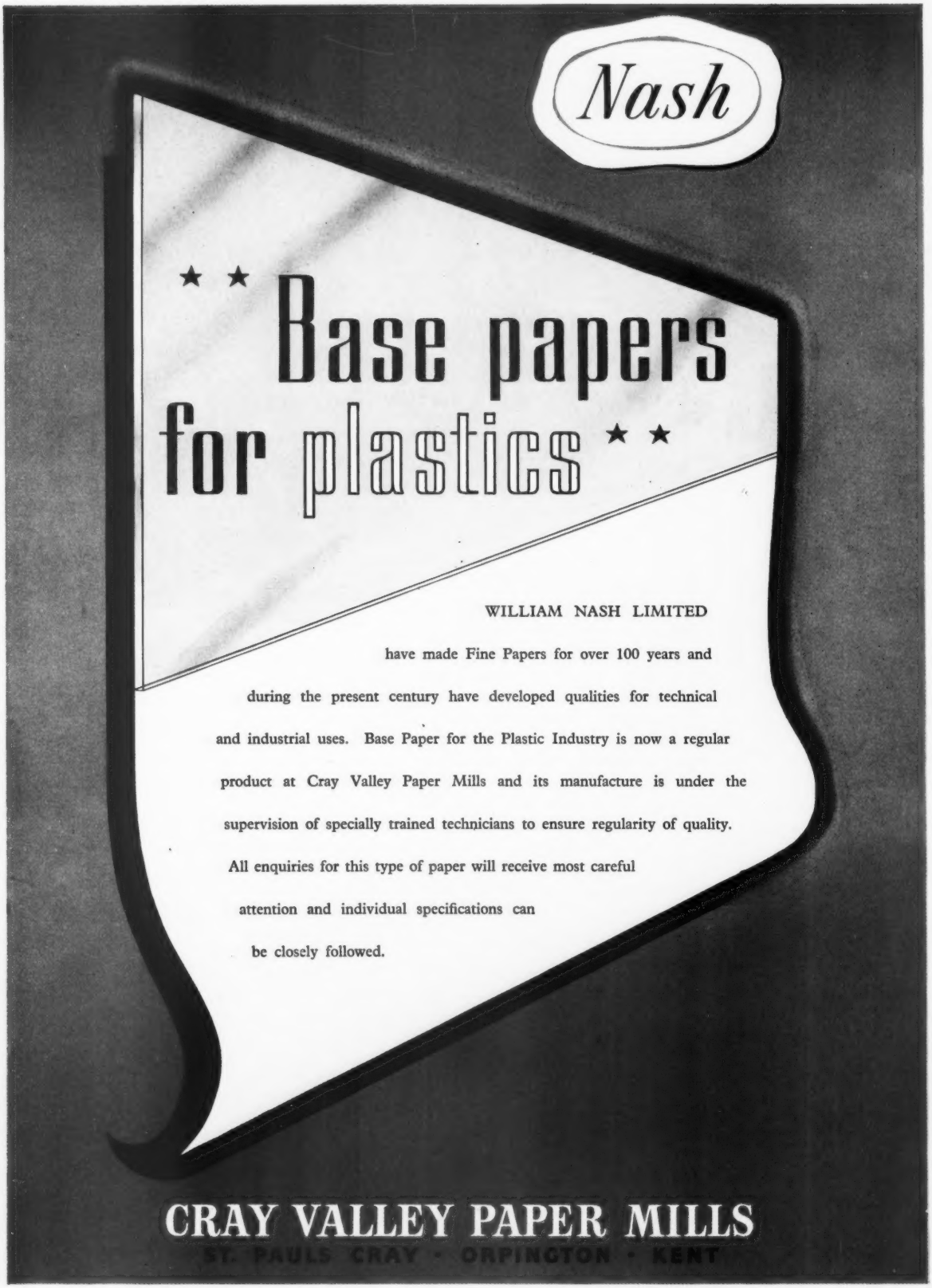
You're RIGHT with 'NESTORITE'

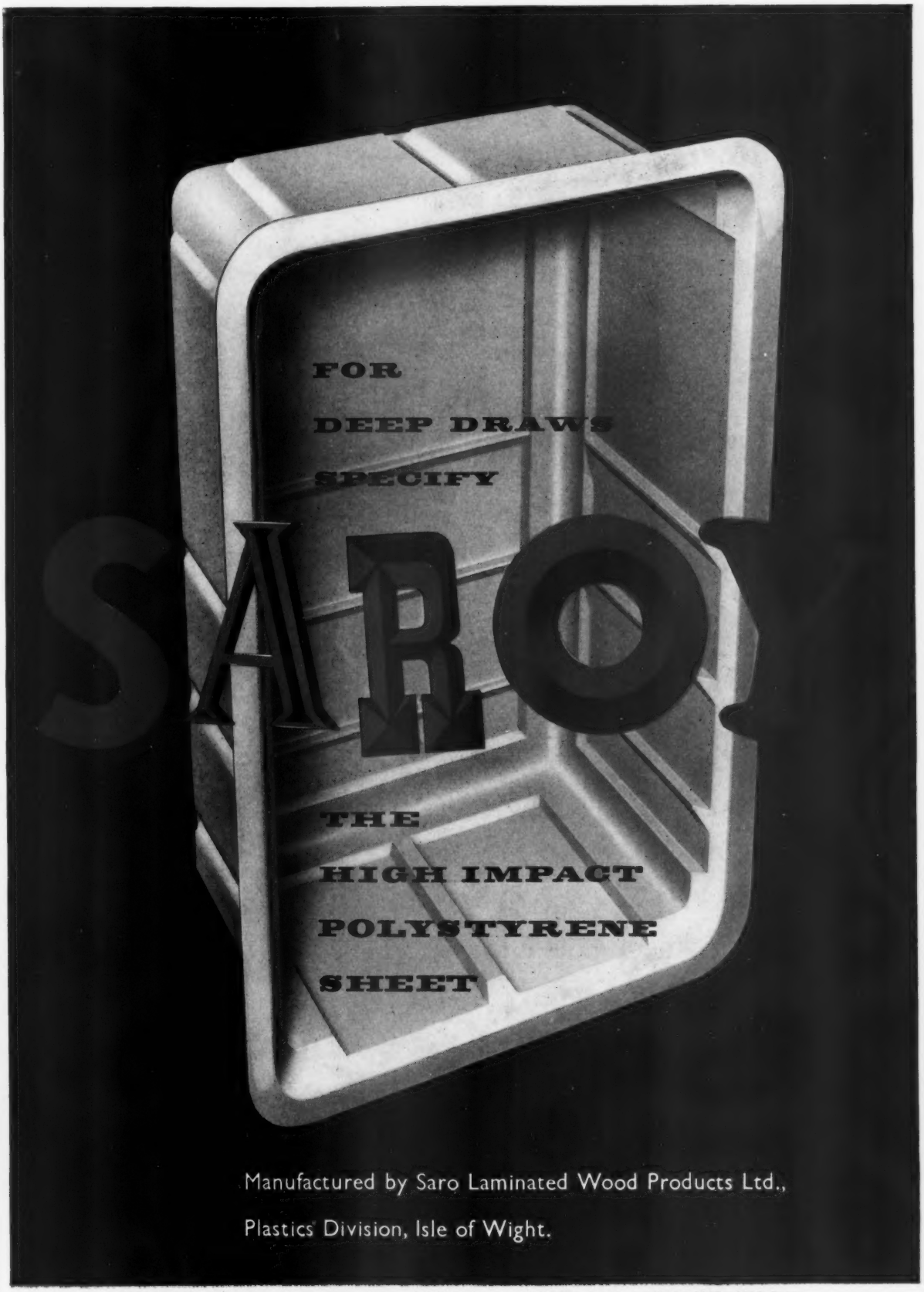
James Ferguson & Sons Ltd.

LEA PARK WORKS, PRINCE GEORGE'S ROAD, MERTON ABBEY, LONDON, S.W.19. Tel: MITCHAM 2283 (5 lines). 'Grams: NESTORIUS SOUPHONE, LONDON

A. S. HARRISON & CO. (PTY) LTD.	85 Clarence St., Sydney, Australia. 120 Wakefield St., Wellington, New Zealand.
ANDRE BERJONNEAU	134 Avenue de Villiers, Paris 17, France.
JOSE DELCLOS MOLLERA	Angel Baixeras 39, Barcelona (2), Spain.
EINAR HOLMARK	19 Gl. Kongevej, Copenhagen V, Denmark.
ALLMANNA HANDELSAKTIEBOLAGET	Stockholm, Sweden.

C


Nash
★ ★
Base papers
for plastics ★ ★
WILLIAM NASH LIMITED
have made Fine Papers for over 100 years and during the present century have developed qualities for technical and industrial uses. Base Paper for the Plastic Industry is now a regular product at Cray Valley Paper Mills and its manufacture is under the supervision of specially trained technicians to ensure regularity of quality. All enquiries for this type of paper will receive most careful attention and individual specifications can be closely followed.
CRAY VALLEY PAPER MILLS
ST. PAULS CRAY · ORPINGTON · KENT



● *This Refrigerator Liner, made from ·125" thickness SAROY, measures 19¾" x 33¾" x 12¾" deep.*

STYRON
Polystyrene

More than any other packaging material, Styron Polystyrene brings shop-window appeal to the point of sale . . . attracts the eye in even the most crowded store. Products appear in the best possible light when seen through Styron. They sell on sight.

Styron sells on clarity—Styron 666 is as transparent as the finest glass, but it is chip-proof and robust. Even more robust is Styron 475, the high impact grade.

Styron sells on colour—Styron is available in sixty standard colours backed by 3000 additional shades.

Styron sells on style—Styron combines the elegant with the functional in round, square, rectangular or decorative containers which can be crystal clear, tinted, translucent or opaque.

Styron sells on hygiene—Styron not only *is* clean, it *looks* clean. It is completely non-toxic and rust-proof.

Have you tried the Six-Six-Six test yet?

Place any product made with Styron 666 alongside products made with other clear polystyrene materials. Without fail, you will detect the Styron product by the superiority of its crystal clarity and sparkle.

For further information about Styron write for descriptive Booklet No. 200 free on request.

Package your product in a STYRON

BRITISH RESIN PRODUCTS LTD

BRP

Sales and Technical Service
Devonshire House · Piccadilly · London W1
Telephone: MAYfair 8867
Manufactured by DISTRENE LIMITED

British made Styron is marketed abroad under the registered trade name 'Distrene'

Shop-window

PHENOL

A high-quality synthetic product meeting the most stringent requirements of the plastics industry.

XYLENOLS

A grade of refined cresylic acid of distillation range approximately 215-230°C. Total tar acid content 99.5 to 100%.

Availability:

Ample supplies for prompt delivery in road tank-wagons and in 40/45 gallon drums.

For further information, consult:

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

ICI

B.244

Plugs that let batteries breathe!

WHEN driving a Service vehicle in varying climates, an efficient battery is vital. A lot depends upon the battery plug! The kind that Messrs. Tungstone Products required was a plug which enabled the battery to breathe! In other words, it must allow acid vapours to escape—prevent dirt penetration—and ensure the return of all condensation to the battery cells.

The problem was: could such a plug be mass produced *in plastic* and still work? That's where Fraser & Glass came in! Because of rigid specifications, the manufacture of this vent plug presented many moulding problems.

After extensive investigation, the technical experts at Fraser & Glass were satisfied that the plug could be made by using a special three-part moulding, so that, finally, the finished plug permitted the free exit of gases and ensured the return of condensation. All possibility of blockage was eliminated, too—a snag difficult to overcome in high speed moulding. Today, these Tungstone plugs can be mass produced at high speed. They are yet another example of the skill and service which Fraser & Glass can offer industry.

If you have a moulding problem in your *industry—no doubt Fraser & Glass can supply the answer.*

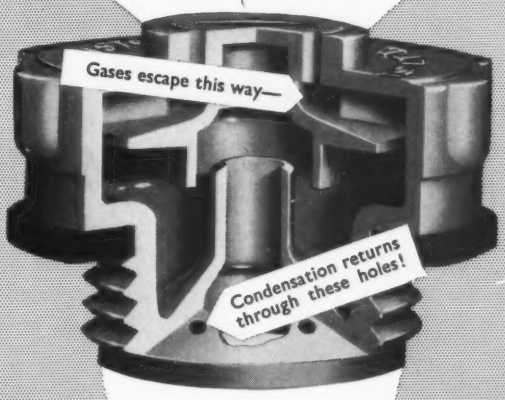
Another problem solved by

FRASER & GLASS

the plastics people

FRASER & GLASS LTD.,
WOODSIDE LANE, LONDON, N.12
TELEPHONE: HILLSIDE 2224-5

How the Tungstone plug works



Grilon
NYLON 6

THE VERSATILE POLYAMIDE PLASTIC

The modern Grilon works and laboratories at Domat/Ems, Switzerland

"Made in Switzerland"
synonymous with
Quality

Manufactured by
Holzverzuckerungs A.G., Zurich.

Deliveries can be made ex-stock London from our exclusive Representative in U.K.:—

for

★ **INJECTION MOULDING**
—the fastest moulding cycles

★ **EXTRUSION**
—the widest viscosity range

★ **HIGH TEMPERATURE RESISTANCE**
—heat stabilised grades

★ **COLD TEMPERATURE RESISTANCE**
—cold stabilised grades

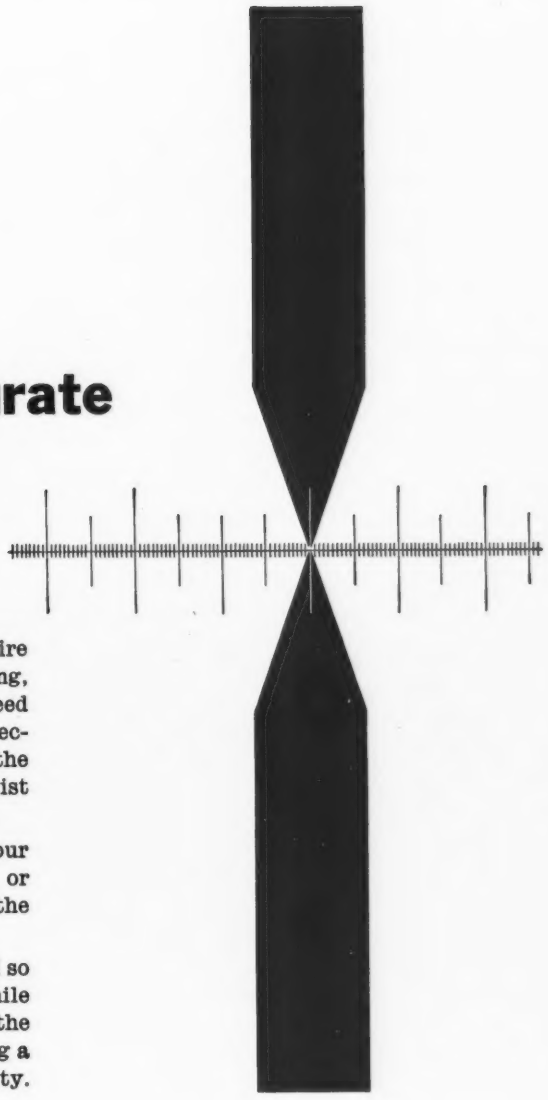
★ **CABLE COVERING**
—various qualities

★ **SPECIAL APPLICATIONS**
—special grades

★ **MONOFILAMENTS**
—bristles, fishing lines, etc.

★ **RODS & SHEETS**
—machining

Nothing more accurate than Electronics



If at some stage in your process you require high operating speeds in sorting, batching, counting, computing, accurate and wide speed control, or non-destructive testing and inspection, electronic equipment can do it. If the appropriate equipment does not already exist it can be designed and made for your job.

Once installed it will last as long as your machines and need little maintenance or attention. It will consistently raise the standard of your products.

Because it does its work so quickly and so well you will find production rising while overheads are reduced. This is only one of the many ways in which electricity is playing a vital part in the drive for higher productivity.

Electricity for Productivity

'Induction and Dielectric Heating', just published, is a very important addition to the E.D.A. series of books on Electricity and Productivity. Other titles available are Electric Motors and Controls, Higher Production, Lighting in Industry, Materials Handling, and Resistance Heating. Price 8/6, or 9/- post free.

If you would like further advice or information on how electricity can improve productivity, get in touch with your ELECTRICITY BOARD, or with *E.D.A.* They can lend you, without charge, films about the uses of electricity in industry.

Issued by the
British Electrical Development Association
2 Savoy Hill, London, W.C.2

D

PLASTICS ELO PRODUCTS

BIRKBYS LTD. LIVERSEDGE, YORKSHIRE

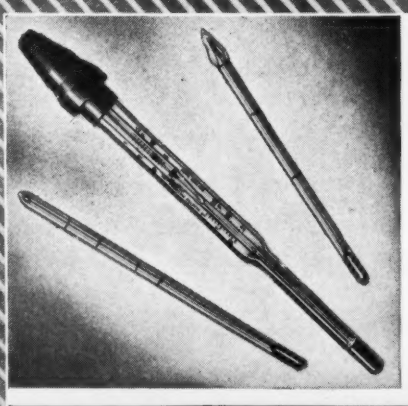
London Office :- 79 Baker Street W.1.

ELECTRO METHODS LTD OF STEVENAGE

BRITAIN'S FOREMOST DESIGNERS

AND MANUFACTURERS OF

TEMPERATURE AND HUMIDITY CONTROLS



An extensive range of
CARTRIDGE THERMOSTATS
and
CONTACT THERMOMETERS
always available for
prompt delivery

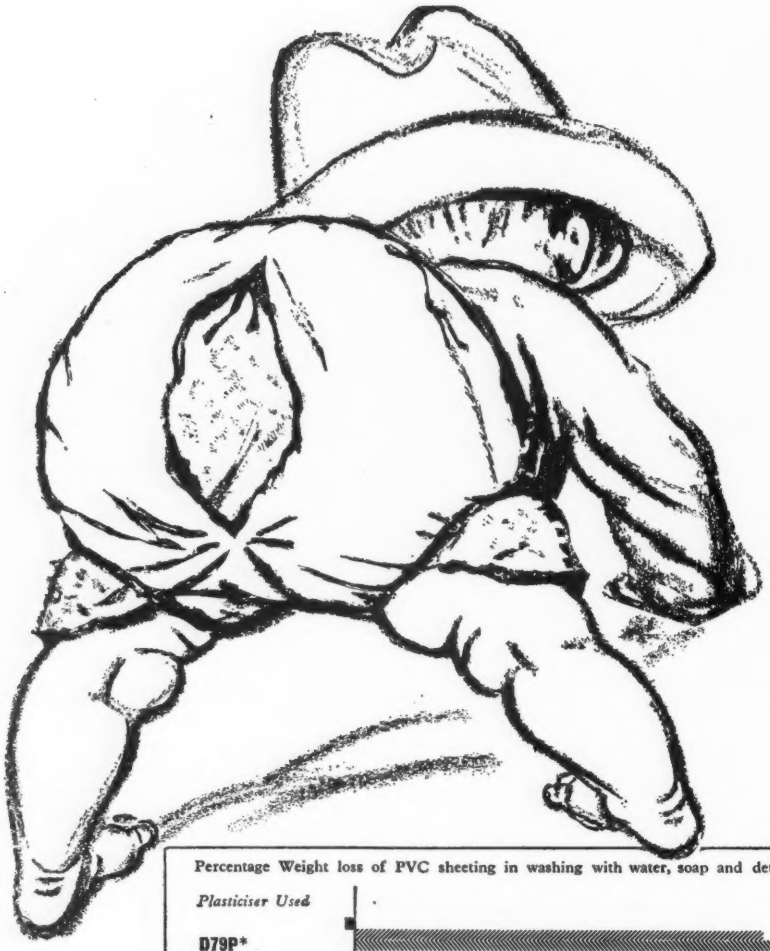
*

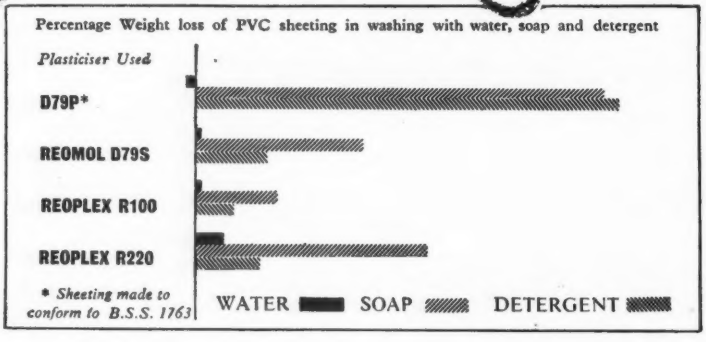
SPECIAL TYPES CAN BE DESIGNED
TO SUIT YOUR NEEDS

*

Full technical data
and illustrated leaflets promptly
forwarded on request

ELECTRO-METHODS LTD. 18-42 CAXTON WAY, STEVENAGE, HERTS. Phone: STEVENAGE 780





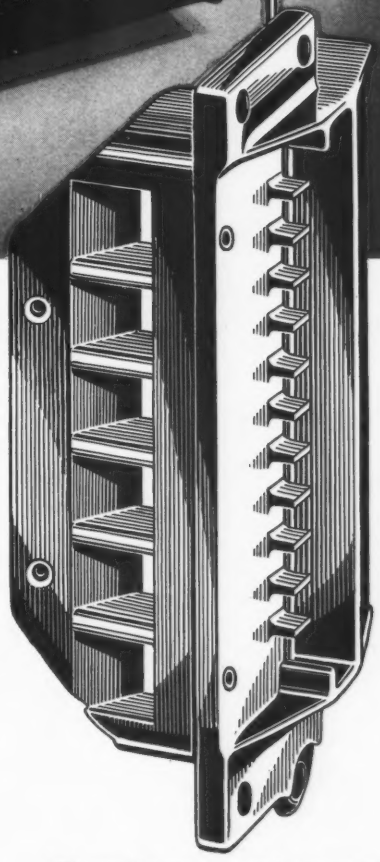
amusing - but quite unnecessary

How tiresome when after only a few weeks' use baby pants harden and eventually split. Tests carried out in the Geigy laboratories have shown that this is often due to the plasticiser used in the manufacture of the P.V.C. sheeting. To-day plasticisers are available with which P.V.C. sheeting can be produced with considerably greater resistance to extraction by normal domestic soaps and detergents than sheeting made to meet only the British Standard Specification No. 1763.

FOR LONG LIFE - USE REOPLEX PLASTICISERS

Full particulars from
THE GEIGY COMPANY LTD., . Plastics Chemicals Division . Rhodes, . Middleton, . MANCHESTER.

P.38.



There are 2 sides to every moulding question . . .

Mere ability to produce mouldings is not sufficient. More important today is a facility to work in close harmony with the designer and to be able to produce mouldings which conform to the strictest engineering specification.

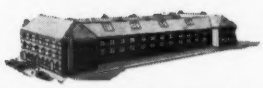
This transfer moulding* shows what can be achieved. The 20 inserts, which are drilled and tapped to American threads, had to be accurately positioned, absolutely vertical, free from moulding material and flush with the surface. The five slots had to be precisely positioned. A tolerance of only .002 in. was permitted over the full $3\frac{1}{4}$ in. length of the 13 pillars and, to make things more difficult, they had to be drilled with holes perfectly concentric. We welcome your enquiries. Our four factories are equipped to handle the large scale production of compression, transfer, injection mouldings.

**The moulding was for a mechanism controlling the make and break action of an intricate card punching machine. It is one of 49 mouldings being made by us for International Business Machines (U.K.) Ltd.*

E. ELLIOTT LIMITED

315 SUMMER LANE, BIRMINGHAM, 19
Telephone: ASTon Cross 1156-7-8-9

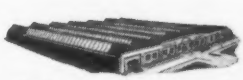
The Plastic moulders with the Engineering background



Walsall Works (Eldon Street)

Victoria Works (Summer Lane)

Cheapside Works



Walsall Works (Bescot Crescent)

Ask

CRYSTALATE

to quote for

MOULDED PLASTICS

Compression, Transfer and Injection Mouldings in Plastics to Customers' Specifications in all Trades.
Synthetic Resin Bonded Paper (S.R.B.P.) Tubes, Bobbins and Formers.

CRYSTALATE LTD., associating MICA PRODUCTS LTD.
Crystalate House, Tonbridge, Kent.
Phones: Tonbridge 2261/5 (25 lines)

58 years experience at your service

KOCH

SIEGBURG
GERMANY

EXTRUDER

FULLY AUTOMATIC HIGH OUTPUT EXTRUDERS AND AUXILIARY EQUIPMENT FOR ALL THERMOPLASTICS IN A FULL RANGE OF SIZES

Features:-

VARIABLE SPEED DRIVE · INDIRECT AUTOMATIC HEATING
ACCURATE TEMPERATURE CONTROL · PATENTED SCREW DRIVE
WELL TRIED CONICAL EXTRUSION SCREW

Enquiries to

TARLAIR LIMITED

33 CORK STREET, LONDON, W.1. *Phone: REGent 0588 Cables: Tarlair, London*

WE REGRET!

that now the 'HUPFIELD' is Fully Automatic the Girl is superfluous

THE NEW IMPROVED HUPFIELD 1¼ & 2¼ OZ CAPACITY INJECTION MOULDING MACHINES

Improvements include, quick purging of heating cylinder, a faster pump giving a 6 sec dry run, adjustment of injection pressure independent of mould locking pressure, a larger plasticizing capacity, and many other improvements which are the outcome of years of experiments in close co-operation with our customer's requirements. For particulars please write to:

PLANT INSTALLATIONS LIMITED

Welton Manor, Welton, Nr. Daventry, Northants

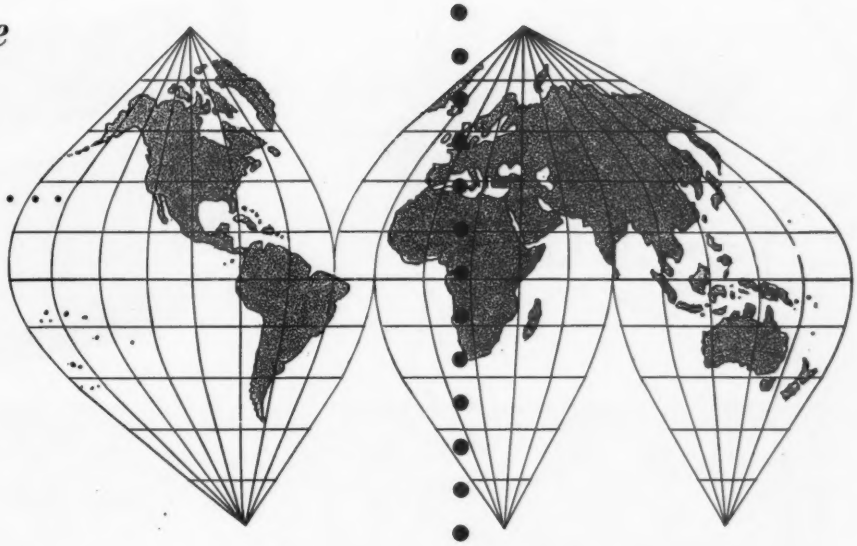
Telegrams: Plant Daventry Telephone: Daventry 257
or the London Works: Hupfield Bros. Ltd., Wordsworth 4488

Suppliers and buyers

of Thermoplastic

materials the

World over . . . .



Reprocessed

P.V.C. Cellulose Acetate,

Polystyrene, Polythene

167 VICTORIA ST., LONDON, S.W.1. *Phone* VICtoria 1823-4-5 & 1414-5-6

GRIST PLASTICS

ONE OF THE DOHM GROUP OF COMPANIES

We'll take it to pieces and put it together with Spire Speed Nuts

If you produce anything that involves fixing one part to another we should like to make you an offer. Here it is: send us a sample of the article you make. Our Product Survey Department will take it to pieces and reassemble it using Spire Speed Nuts, Screws and Clips. Your product will then be returned with an illustrated Fastening Analysis, showing what you would save in time and money by assembling with Spire Fasteners. THIS TECHNICAL SERVICE IS FREE OF CHARGE. If you're interested (and you should be!), drop us a line and we'll send you full details—or call in our Technical Representative, he's a fastening specialist.

Anything you fix Spire can fix faster

Enquiries to: **SIMMONDS AEROCESSORIES LIMITED**
Spire Speed Nut Division,
11a, Albemarle Street, London, W.1.
Tel: HYDe Park 5741/2

Head Office & Works: TREFOREST, PONTYPRIDD, GLAMORGAN.
Branches: Birmingham, Manchester, Glasgow, Stockholm, Copenhagen, Ballarat, Sydney, Johannesburg, Amsterdam, Milan and New York.

A MEMBER OF THE FIRTH CLEVELAND GROUP

CRC 465

New additions to
the existing range of grains

FROMOTAN
Plaited
single and two-tone effects

FROMOTAN
Scotch cord
single and two-tone effects

FROMOTAN
Nappa
in gauges up to ·024"

FROMOTAN

'AMERICAN CALF'
CONTINENTAL CALF
available in all standard and latest Spring colours
in thicknesses from ·012" to ·018"

FROMOCENE *plain, printed and Laminated*
Gauges from ·004"

WALLINGTON WESTON & COMPANY LIMITED
Frome, Somerset. Frome 2206/7/8
London Office: Premier House, 48 Dover Street, W.1. Grosvenor 6512/3140
Manchester Office: Collingham Street, Manchester, 8. Deansgate 6307

the NEW WP PLASTIFICATOR

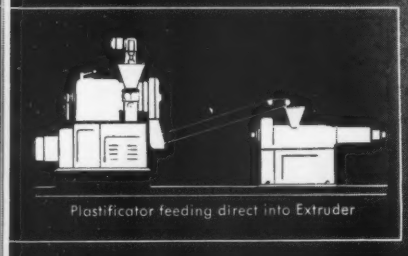
(WACKER SYSTEM)

A continuous process machine for

GELLING
PLASTICISING
COMPOUNDING
GRANULATING

. . . . all types of Polyvinyl materials, particularly suitable for hard-to-gel PVC suspension Polymers with or without Plasticiser at a rate of up to 300 lbs per hr.

Please ask for illustrated brochure giving further particulars.



Plastificator feeding direct into Extruder

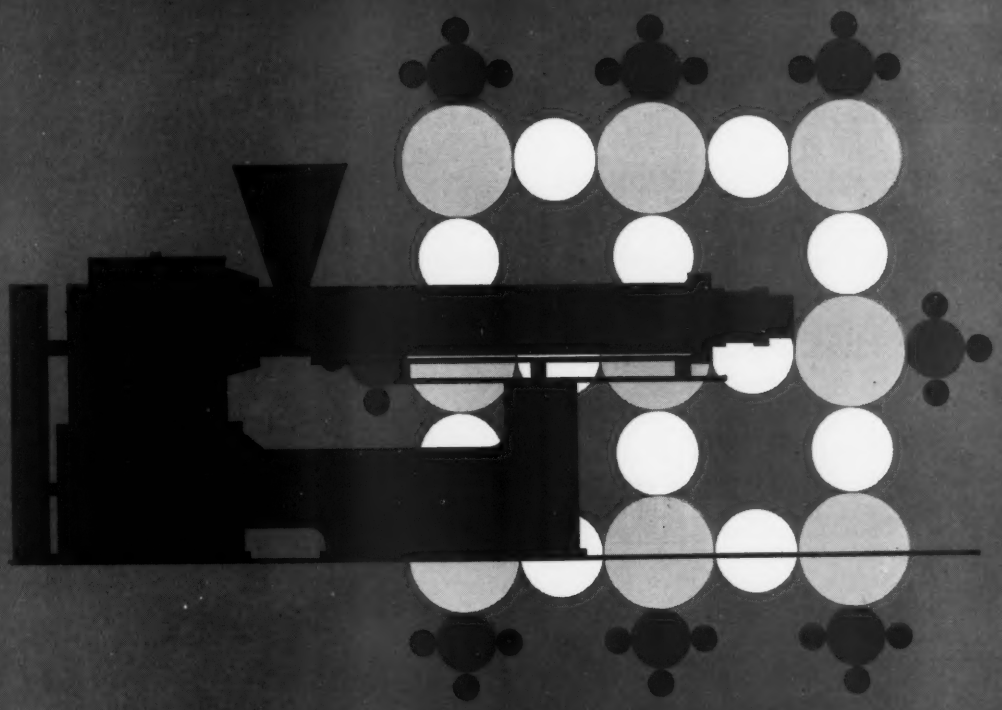
Manufactured by **WERNER & PFLEIDERER** *to those standards of Design, Construction and Workmanship which have been their tradition for many years.*

Consult

JOHN KIMBELL & CO., LTD. (PLASTICS DIVISION)

39 VICTORIA STREET • WESTMINSTER • LONDON • S.W.1

Telephones : ABBEY 7193 *Telegrams :* JONKIMBELL, LONDON, TELEX



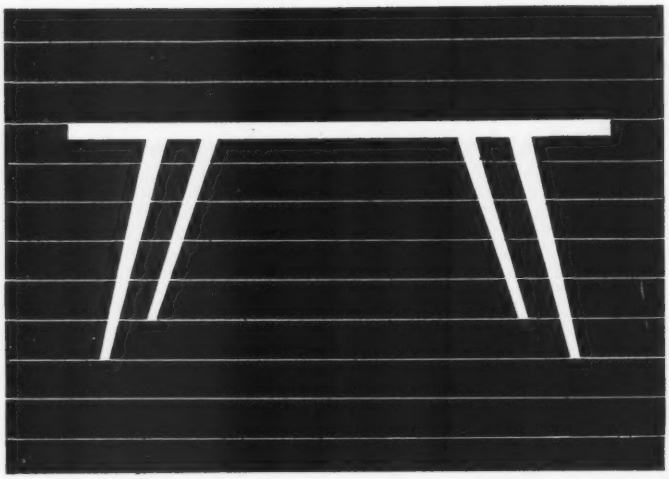
Out-of-the-ordinary

I.C.I. Silicone Rubbers are certainly out-of-the-ordinary materials. They retain their elasticity at temperatures down to —85°C, where natural rubber would become rigid and brittle, and will withstand continuous exposure at temperatures up to 250°C—and higher for short periods—without decomposing. In addition they combine excellent electrical properties and exceptional ozone resistance. Yet, when it comes to processing, I.C.I. Silicone Rubbers present no special problems. With excellent general moulding and extrusion properties, they are frequently easier than natural rubber to process on standard equipment.

I.C.I. SILICONE RUBBERS —*Material Progress*

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

N.S.31



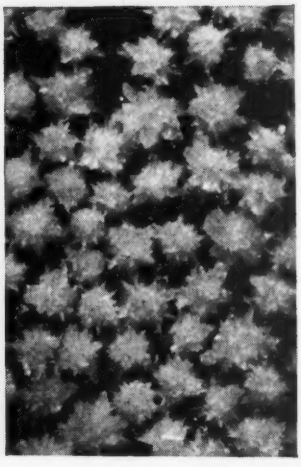
Melamine
is on top

in decorative
laminates

Marvellous Melamine!

Melamine in
moulding powders

for today's tableware



Melamine crystals

British Oxygen Chemicals
supply Melamine to makers of res'ns and moulding powders for–

TABLEWARE • DECORATIVE LAMINATES • FABRICS • PAINTS • PAPERMAKING

BRITISH OXYGEN CHEMICALS

BRIDGEWATER HOUSE, ST. JAMES'S, LONDON, S.W.1 TEL: WHITEHALL 9777

THE ESTERBROOK DESK PEN SET—

something to write home about

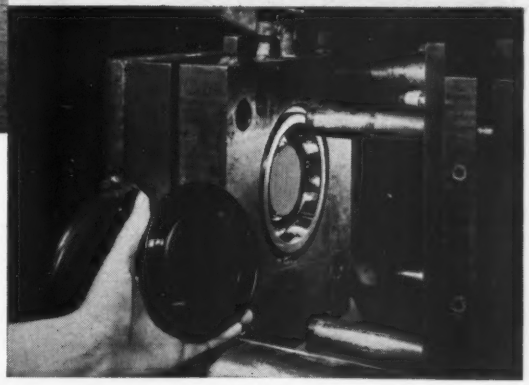
The Esterbrook Desk Pen Set is marketed as a single or twin set (as illustrated) in various combinations of black, grey and cream. The pen tapers are in cream, red or clear colours.

This is an excellent example of Streetly thermoplastic moulding.

Always before critical eyes, these desk sets have to be of exceptionally fine finish; they are accordingly moulded to very high standards—in the case of the pen tapers even to optical standards.

Each set is subject to meticulous inspection before delivery, as are all Streetly mouldings.

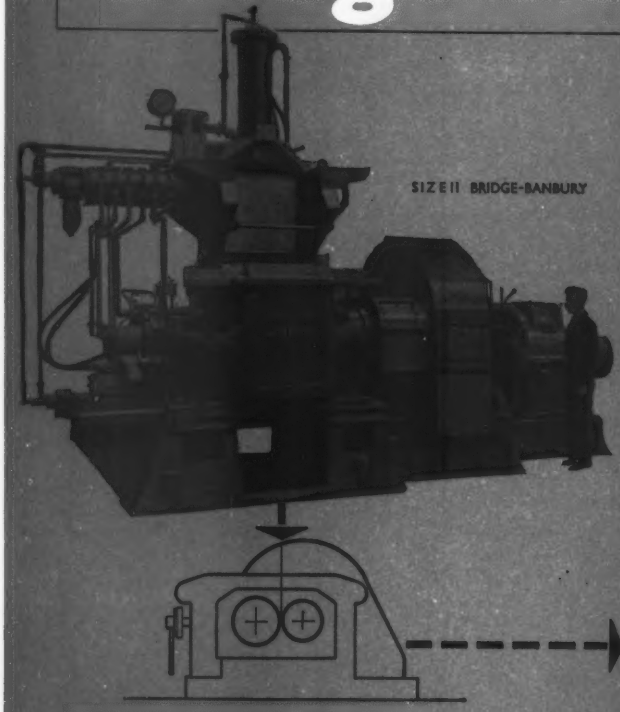
Streetly moulds the four pieces shown above, the bases (Polystyrene), inkbasket (Polythene), lid closure (Bakelite), and pen taper (Polystyrene or Diakon). The pen tapers have to be moulded to optical standards to avoid blemishes which would be magnified in the mouldings. At right is shown the single impression mould and one of the moulded bases.

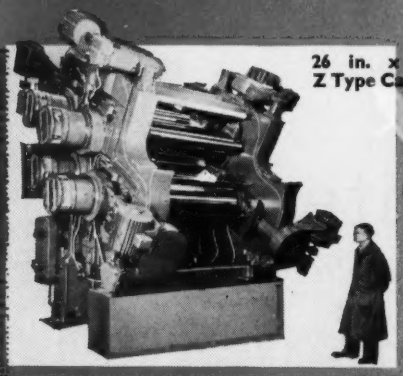


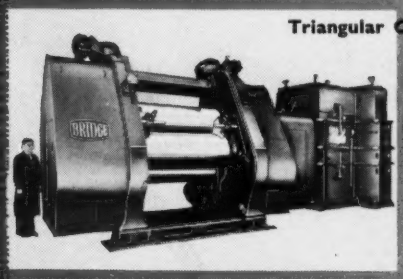
B·I·P **STREETLY MOULDINGS** *the comprehensive moulding service*

THE STREETLY MANUFACTURING CO. LTD., Streetly Works, Sutton Coldfield. *Phone:* Streetly 78411

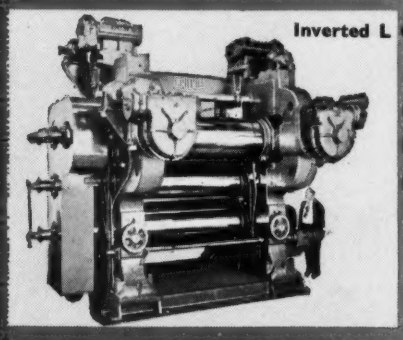
Bridge-Banbury *Automation*

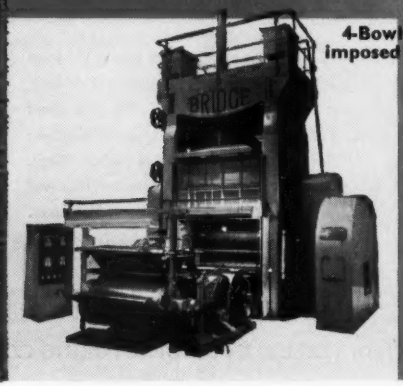



26 in. x 66 in. Z Type Calender I



Triangular Calender


Inverted L Calender



4-Bowl Superimposed Calender

Calenders

FOR BRIDGE-BANBURY MATCHED PRODUCTION UNITS

The size and design of the Bridge-Banbury and mill assure an even flow of properly conditioned material for the Calender so that the most economical and highest quality production may be obtained. The mill is matched in capacity to take the full output of the Mixer without either overloading or starving the production line. The Calender which may be either superimposed inverted L, Z or triangular is in ideal balance with the Bridge-Banbury and mill. Driven by an adjustable-speed motor the output speed may be set according to the gauge of stock being run. This matched production equipment has contributed to the rapid growth of the industry and is in wide use all over the world.

DAVID BRIDGE & CO. LTD.

In technical association with Farrel-Birmingham Co. Inc. U.S.A.

CASTLETON, ROCHDALE, ENGLAND.

Phone: Castleton (Rochdale) 57216. Grams: Coupling Phone Castleton Lancs. London Office: Broughton House, 6, 7, 8, Sackville Street, Piccadilly, London, W.1. Telephone: Grosvenor 7480. Grams and Cables: Ederacco Piccy London

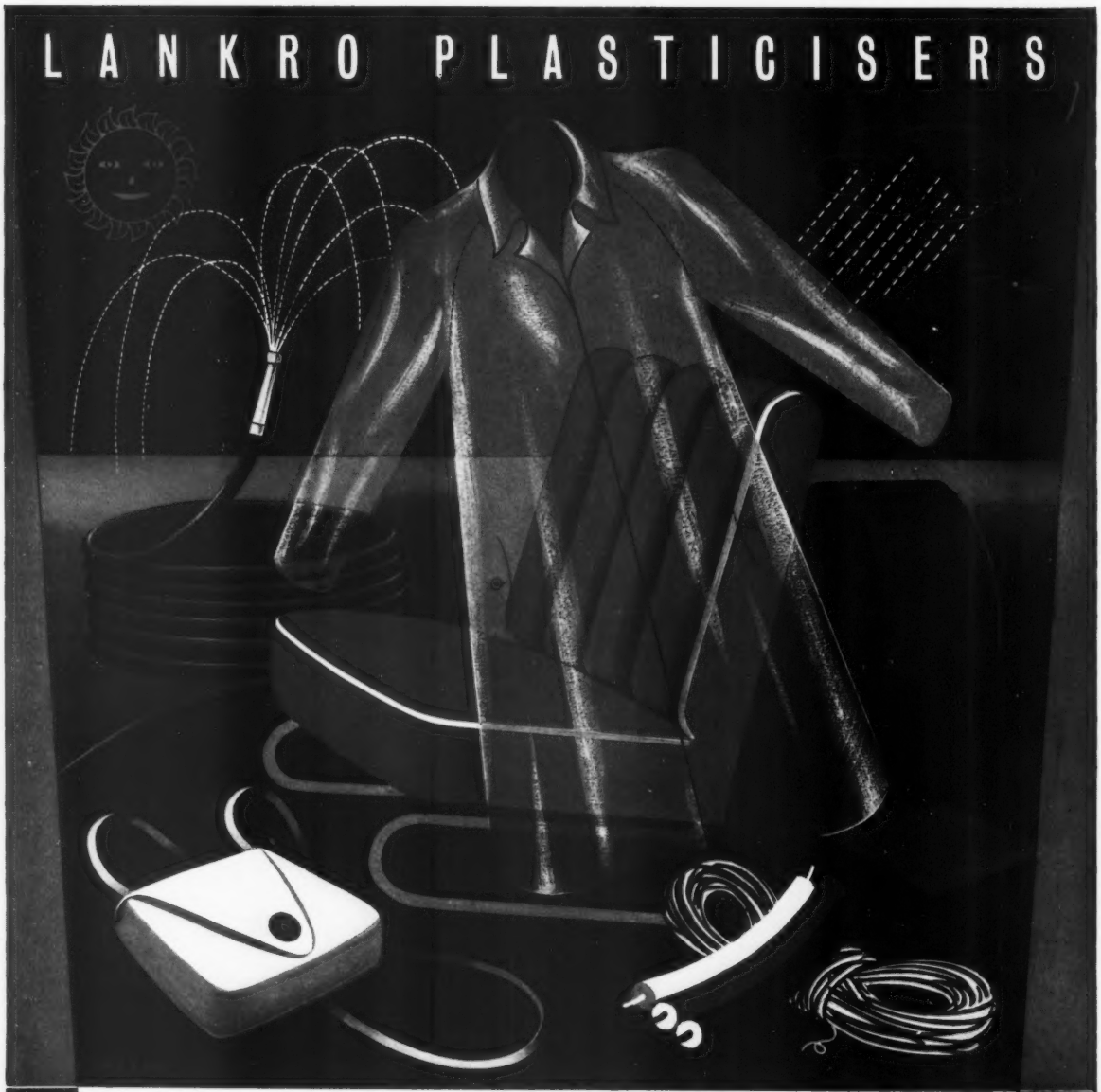
M&B PLASTICS LTD

DISTRIBUTORS OF M&B BRAND PLASTICS FILMS

MANUFACTURED BY

MAY & BAKER LTD

LANKRO PLASTICISERS



PHTHALATES: DBP. DAP 79.
DNP. DIOP. DOP. DCP.
LANKROFLEX 29.

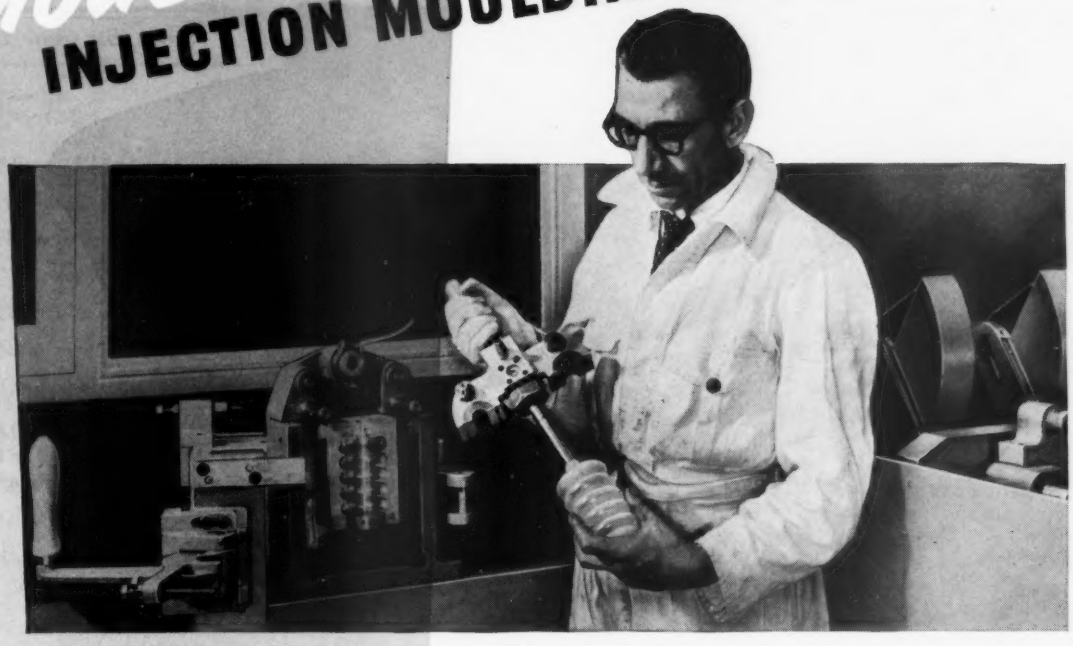
SEBACATES: DOS. DAS 79.
DIOS.

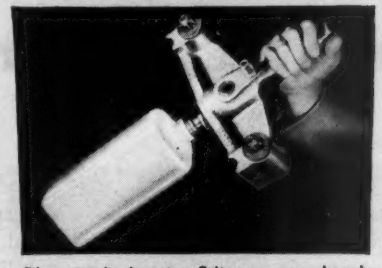
SPECIALITY PLASTICISERS:
BAR. LANKROFLEX ED 3.

STABILISERS.

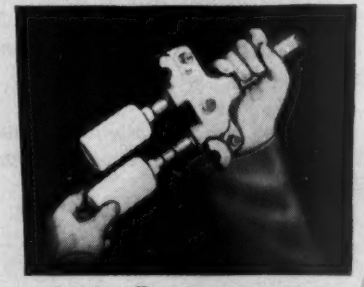
LANKRO CHEMICALS LTD., ECCLES, MANCHESTER, TEL. ECCLES 5311-5316

BLOW MOULDING ON YOUR INJECTION MOULDING MACHINES





Blow stick showing 2 litre square bottle



Standard Twin Impression Unit

Increase the scope and profit making potential of your moulding equipment with a Granbull Blow Moulding Unit. It is used in conjunction with any standard moulding machine, converting it for blow moulding at a fraction of the cost required for special purpose machinery. Write for full details of the Standard and Major Units, stating your specific requirements and giving the type and capacity of your moulding machines.

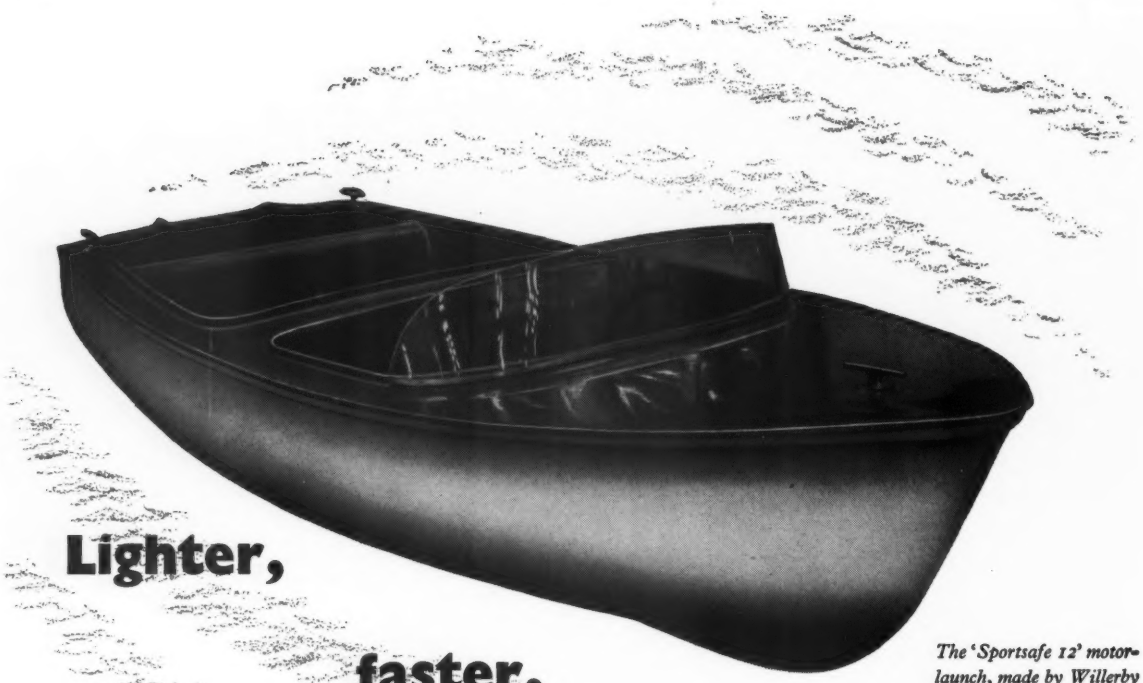
- ★ ADAPTABLE TO ANY STANDARD INJECTION MOULDING MACHINE
- ★ SUITABLE FOR LONG OR SHORT RUNS
- ★ SINGLE TWIN OR MULTI-IMPRESSION
- ★ ELIMINATES HEAVY COST OF SPECIAL PURPOSE MACHINERY

Agencies in principal countries

THE GRANBULL TOOL CO. LTD

Registered Office and Works

39 HIGH STREET • KINGSTON-ON-THAMES • Tel: KINGSTON 3322



Lighter, faster, safer craft . . .

The 'Sportsafe 12' motor-launch, made by Willerby Plastics, of Willerby, Yorks

and minimum maintenance!

Smooth, flowing form with strength and durability . . . that's the beauty of boats moulded from BAKELITE Polyester Resins reinforced with glass fibre. This trim motor-launch is made from two lightweight BAKELITE Polyester Resin/glass fibre shells, and has a very high buoyancy reserve. Smooth hull and beautifully flared bows were easily moulded without any elaborate equipment, and maintenance is reduced to a minimum because BAKELITE Polyester Resin/glass fibre is non-absorbent, rot-proof and resistant to marine growth. Accidental damage can be quickly and inexpensively repaired.

BAKELITE Polyester Resins are already successfully employed in many industries. Commercial and passenger vehicle components are made from them, as well as aircraft components, caravans, complete car bodies and machine guards. There are many more applications for this material, which combines lightness, strength and resistance to corrosion with ease of production.

Write or telephone for more information and technical data on BAKELITE Polyester Resins and the latest information on production methods.

BAKELITE TRADE MARK *Polyester Resins*

Bakelite Limited manufacture an extensive range of plastics materials and maintain a technical service unequalled in the industry. No matter what your plastics problems this service is at your disposal. SLOane 0898 is the telephone number.

BAKELITE LIMITED • 12-18 GROSVENOR GDNS LONDON SW1 • SLOane 0898

TGA RP8

Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

CONTENTS

Editorials 111

Moulding Powder and Shot 112

Fluon Goes to Work 113

" Plastics in the Service of Man " ... 118

Letters to the Editor 122

New Vacuum Forming Machine ... 122

The Manufacture of Nylon 6 in Switzerland 123

Polymers from Oxa*cyclo*butanes ... 126

New American Polymer 127

New Productions... 128

The Burtonwood-Andouart 90 mm. Extruder 130

Injection Moulding in Dentistry ... 133

World's Industry Employs Plastics ... 134

Plastics News 135

Automation Equipment 139

Talking Shop 140

The Properties and Testing of Plastics Materials—Part 9 (cont.), by A. E. Lever and J. Rhys 141

The Effect of Carbon Black on the Stability of Polyethylene, by John T. Moynihan 143

Patent Review 146

EDITOR: M. D CURWEN, B.Sc., A.R.I.C.
ASSISTANT EDITOR: C. W. WELCH

Published monthly by the Proprietors, Temple Press Limited, and printed in England by Sir Joseph Causton & Sons, Ltd., London and Eastleigh
Annual Subscription Rate 36/–. Shorter periods pro rata

Editorial, Advertisement and Publishing Offices: Bowling Green Lane, London, E.C.1
Telephone: TERminus 3636

Packaging " Grilon " nylon at the Swiss works of Holzverzuckerungs A.G.

NP50

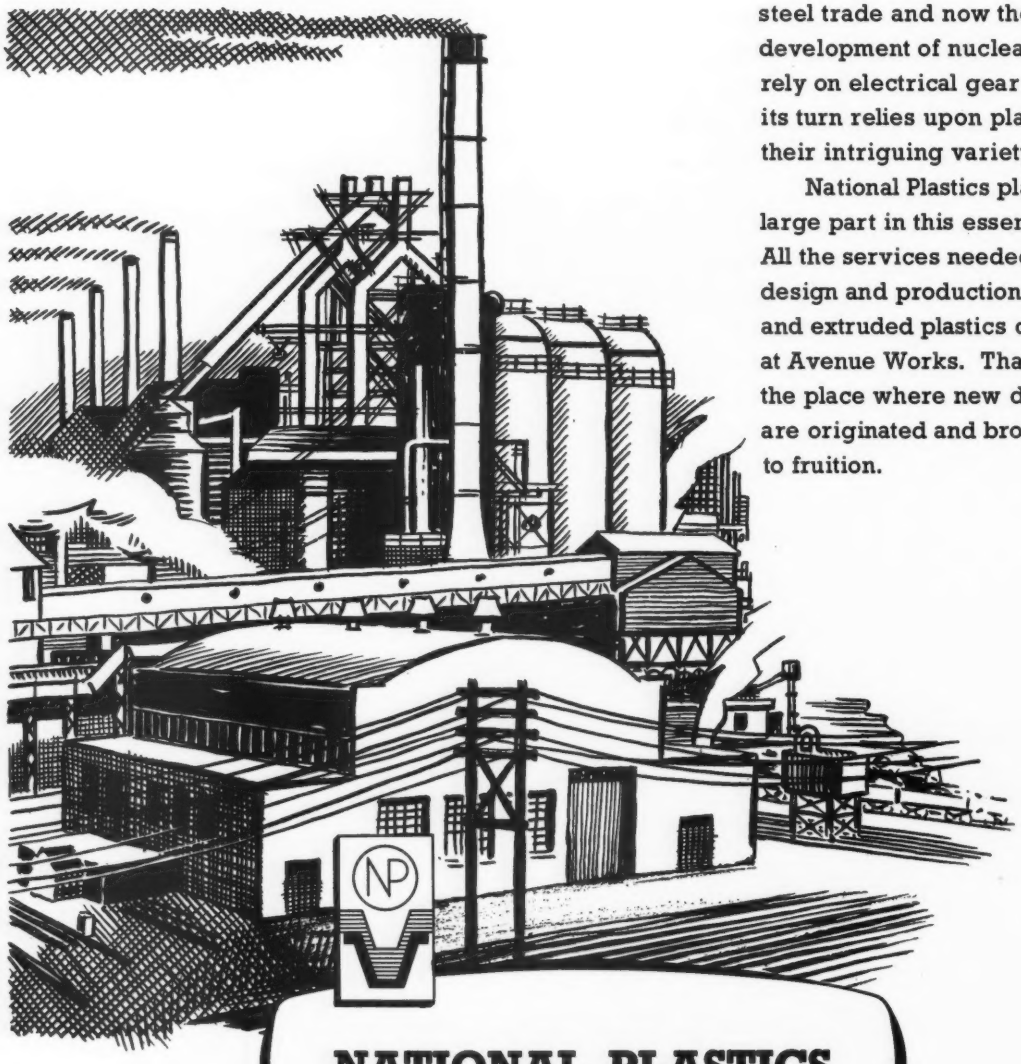
born to blush unseen

. . . it's a sobering thought for the maker of plastics components to realise that a large part of his production disappears into the intricacies of electrical gear and is seen no more.

Sobering, yet pride making, for in little more than a quarter century, plastics components have won for themselves a most important place in British industry.

Vast enterprises such as the steel trade and now the new development of nuclear power, rely on electrical gear which in its turn relies upon plastics in all their intriguing variety.

National Plastics play a very large part in this essential work. All the services needed for the design and production of moulded and extruded plastics can be seen at Avenue Works. That, too, is the place where new developments are originated and brought to fruition.



NATIONAL PLASTICS

MAKERS OF PLASTICS MOULDINGS AND EXTRUSIONS ON A VERY LARGE SCALE

NATIONAL PLASTICS (SALES) LTD., Avenue Works, Walthamstow Avenue, London, E.4
Telephone : Larkswood 2323

Plastics

VOL. XXII No. 235 APRIL, 1957

EDITORIALS

P.T.F.E.

MORE than ever do the facts of polytetrafluoroethylene impress themselves on our mind. As we related in our last month's issue, we recently had occasion to see the first exhibition held in this country of components and units made from it. We coupled this view with a visit to the p.t.f.e. section of I.C.I.'s technical service laboratories to learn the technology of transforming this plastic into the said components: into mouldings, tubes, rods, film, and so on.

What we saw made it quite clear to us that here was a material that more than any other polymer, satisfies the demands of our modern scientific and technical world—a world of automatic and electronic devices with their new specifications for exceptional dielectrics of long service at very low and high temperatures, of the expanding fields of chemistry and engineering with their insistence on special chemical resistance, on permanence, toughness, self-lubrication, and so on.

Finally, to round off the story, and to complete our elementary education in this fascinating subject, we received the singular honour of being invited to I.C.I.'s factory in Lancashire where the p.t.f.e. is manufactured. Here in uninhibited freedom, we were permitted to examine in chemical and chemical engineering detail, a very remarkable factory.

It is thus we are able to present to our readers elsewhere in this issue a comprehensive story of this new plastic with some completeness: the preparation of the monomer from a liquid normally used as a refrigeration medium, the transformation of the monomer tetrafluoroethylene to its solid polymer form, the special technology employed for its moulding, extrusion and fabrication and finally where and why the components and units so made are employed in modern industry.

In our contacts during the past 30 years or more with the chemical and plastics industry we have seen a great variety of factories, but we have never seen the like of the p.t.f.e. one. This sounds a platitude when speaking of new structures but let us explain what we mean and what we do not mean.

It is not a large factory as plastic factories go, for production capacity is only 200 tons a year—polystyrene, polythene and p.v.c. factories are now being built in units of 5,000 to 10,000 tons a year. The fact that 200 tons of p.t.f.e. sells for some £800,000 at present prices, does however give food for thought as to the whys and wherefores of the type of factory it is.

It is not that the basic principles of the polymer production are especially different from any other. The fundamental difference lies, of course, partly in the character of the raw material, the special plant required to make the new monomer from it, the exceptional precautions necessary to produce it in an absolutely pure form and finally the extraordinary care to pursue this insistence on purity at all points of the production of the polymer up to the finishing stages when " purity " in the chemical sense becomes " cleanliness " in the open factory sense. This purity and cleanliness is far more important to p.t.f.e. than to any other plastic. It is a characteristic of p.t.f.e. as important as the dielectric properties which are probably proportional to it. The attainment of such high standards is perhaps one of the most remarkable characteristics of this factory.

Again we must stress how important we believe p.t.f.e. is to the plastics moulding and fabricating industry which has so far neglected its advent. It is true that the techniques are somewhat different, but they are far from being difficult and understanding will certainly bring its own reward. The plastics industry, whose largest customer has always been and still is the electrical industry, must surely see that this new dielectric is part and parcel of their future livelihood and can employ its long experience with great effect. It would be disastrous if we remained inert to the implications of these modern advances.

Europe's Expansion in Plastics

PERHAPS the greatest industry change that has swept over the European scene concerns the extent to which petroleum chemistry has been accepted as an aid and challenge to the chemistry of coal carbonization. The orientation away from coal is no doubt a result of diminishing coal resources, the increased cost of winning coal and ever increasing demands for electrical energy, but there is also the fundamental knowledge that not only are petroleum products the bases of so many synthetic plastics and chemicals that cannot be made from coal, but that many coal-derived chemicals are possible from petroleum sources.

The tempo has been speeded up enormously by the development of the Middle East sources of oil in post-war years, and also the exciting possibilities of new discoveries in Italy (especially natural gas) and in France in the Bordeaux districts and in her North and Central African possessions. Great Britain has very few natural resources, but these have been increased in recent years to a useful 1,000,000 tons per annum.

The movement in Great Britain has already been fully described, and the names of I.C.I., British Hydrocrabon Chemical Co., Monsanto, Esso, Union Carbide, Forth Chemicals, Distillers, Shell and Petrochemicals, and Dunlop, stand out in a gigantic drive to produce ethylene and propylene for polymer and chemical production. Of these the Grangemouth and Fawley works alone will crack some 600,000 tons of oil between them. Germany has also increased her petroleum chemical industry after relying so much on acetylene, and here, Bayer, Hoechst, Lurgi, Ruhrgas, Rheinische Olewerke and others, have created massive ethylene and ethylene oxide plants. The last named has increased its polythene production to 35,000 tons per annum.

France in pre-war days was not considered among the major producers of plastics or chemicals but expansions are now going ahead at a rapid pace. The Société Ethylène Plastique, which uses the I.C.I. process of polythene production, is expanding to some 14,000 tons per annum, and the same process is being applied by Péchiney, Air Liquide and Houilles, Goudron et Derivés.

Italy, which has recently shown great activity in several industrial fields now advances also into that of petroleum chemistry, as witnessed by the results of the Natta school and the promise of new polythenes, polypropylene and the new polystyrene. Montecatini is no longer the only large company interested, for Monsanto, the A.N.I.C., and the government-controlled Ente Nazionale Idrocarburi company are all making progress in the foregoing, in synthetic rubber developments and in the search for petroleum at home and abroad.

Nor must Holland be forgotten since here scientific and technological advances in rubber and petroleum are of the highest order. The latest information shows that a 5,000 tons a year Ziegler polythene plant is to be erected although for the time being the ethylene will be produced from coke-oven gases.

There is little doubt that Europe, if considered as a close

working unit, as some hope it will be, has reached a level of industrial development fast approaching that of the United States. With its magnificent history of scientific, technical and industrial power, Europe could surpass it and that of any other growing nation.

Research in a New Field

TWO lectures at the Plastics Institute's London Section Symposium, recently, created a train of thought that no doubt has been running through the minds of many scientists and technologists. Outwardly disconnected, the lectures had a commonalty of interest in one particular aspect of polymers, namely the question of molecular weight and mass.

Dr. von Klenck, of Farbwerke Hoechst, delivered a paper on low pressure polythene, in the course of which he discussed molecular weight as a function of mouldability. In essence he pointed to the limitations of present polythenes, in terms of mechanical behaviour, whether of the low or high pressure type, and underlined the point that whilst superior properties *could* be obtained by employing much higher molecular weight materials, the problem is, at this point in time, how to process them? Our present fabricating plant has not been designed to handle such intransigent materials, having a very high melt viscosity.

The second lecture, by Ir. Kessler, of Algemene Kunstzijde Unie N.V., comprised a report on an investigation into the structure of nylon 6 in the mass. Here studies were made first on microtome sections cut from standard moulding grade granules. Microscopic study disclosed the fairly common spherulite structure, giving a " Maltese Cross " pattern, these essentially crystalline areas being linked by small amounts of amorphous material. The crystal structure formed the core of the mass, whereas at the sub-surface, pallisades, or narrow vertical crystals were predominant. The diameter of the spherulite was approximately 500μ, or 0.05 millimetres. From this stage, research was carried out on moulded pieces, where it was found that if this structure of spherulites and pallisades were retained, the moulding would be stress free and of sound mechanical properties. If the structural pattern had been destroyed, mechanical failure would be expected.

The foregoing brief account is merely to link the concept of the structure of the mass as influencing the properties of a moulded object with the clear indication that mere improvement of polymerization processes, such as low pressure catalysis, is only the beginning of the production of superior materials.

That alterations in the arrangement of the mass, without any change in the polymer, can radically alter the properties of the polymer is indicated by a recent E. I. du Pont report (No. 56/10, 1956) from Wilmington. Discussing surface coating materials, reference is made to blends of Hypalon (chlorsulphonated polythene) and polythene, the former to impart adhesive properties and the latter anti-tack properties to the coating. Blended at 220° F. to 250° F. on open roll mills, such compounds are insoluble in toluene and xylene *until* they have been relaxed by a further period of milling on cold rolls. The du Pont explanation is that the first hot milling results in molecular packing and makes the mass insoluble in the solvents mentioned above. Cold milling relieves this " packed " state, and the solubility is restored.

We suggest that the work of Griffiths and others on the physical factors involved in moulding and extrusion are in line with the foregoing, and that we may well see in the work of A.K.U., the outlines of a new field for study.

Moulding Powder and Shot

So far as the present outlets for p.t.f.e. are concerned, this month's " Plastics in the Service of Man " on page 118 gives a fairly diverse picture of the various existing applications. Many are missing for space limitations and could include p.t.f.e. " wool " for pipe- and tap-joint wrappings, ball valves, ski and sledge runner surfaces, impregnated porous powdered metal bearings, etc.

Let's stop and think.

I have always thought it an interesting and sometimes fruitful game to try and put down on paper the various theoretical uses of a given plastic quite irrespective of price, since price seems merely proportional to time and place. It presupposes an adequate and wide, but not necessarily intimate, knowledge of many industries and the processes involved. To illustrate what I mean, let us put down a few examples however far-fetched; for the present purpose we can exclude the electrical and chemical industries which know so much about p.t.f.e. already.

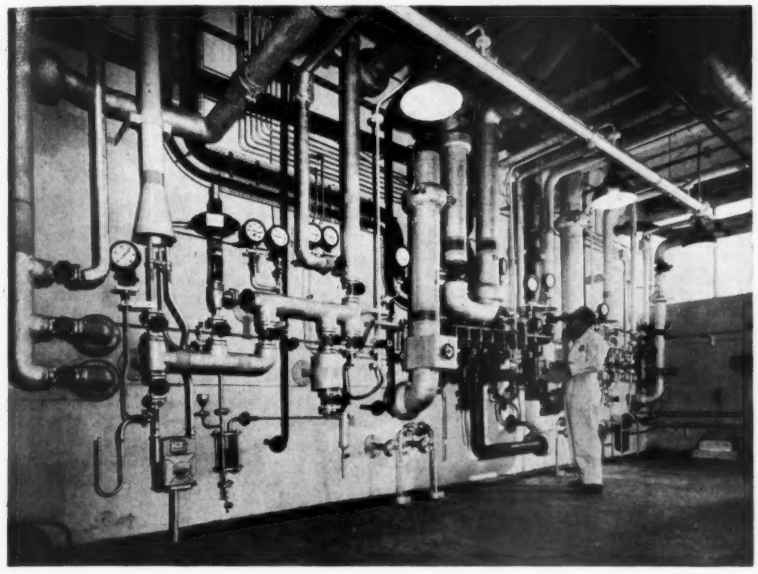
1. Chemical laboratories: Stirring rods, spatulas, etc. (p.t.f.e. coated metal), non-stick, non-lubricated burette and separating funnel cocks and stoppers.
2. Chemical plant: Mixer, agitator and scraper-arm extensions to provide p.t.f.e. to metal contact. Surfacing of metal drying trays for acid and high temperature work replacing enamelled trays, tipped rakes, coated shovels for acid fertilizers.
3. Textiles: Spinning guides to prevent fibre breakage: glass fibre spinning ? Fabric for filter cloths.
4. Paints: As for mixers above, surfacing for grinding mills, coated metal balls for pigment grinding, lining of paint mixers for ease of cleaning.
5. Explosives: Edging or coating of tools for spark prevention: filler extrusion dies.
6. Metal pickling: If it is true that p.t.f.e. resists nitric acid, perforated metal rotating containers coated with p.t.f.e. could replace the costly earthenware type so prone to damage.
7. Reinforced plastic structures: Brushes (as " wool " pad or bristles), rollers and lined buckets for glass fibre resin impregnation to improve ease of cleaning. (Don't say I don't help the brush and bucket brigade!)
8. General: " Static " air filters, coating of fan blades in high temperature acid fume extraction, high temperature oil filters, ball-bearing races. De-icing surfaces on air-screws and carburetors have already been suggested.

* * *

The American technical, financial and even non-technical journals such as *Fortune* are all reporting on the Young Process of resin/glass fibre reinforcements production which appears, in a broad sense, to be one of the most interesting developments of, yet differs considerably from, the original resin-impregnated cellulose fibre slurry process first developed in pre-war days. So far as glass fibre/resin technology is concerned, it is clearly the first to break away from the " dry " process and strict adherence to the use of glass fibre only, by employing a water slurry of both chopped glass fibre and organic fibres to produce a preform by pressure through a screen. The wet preform is then dried and placed in a mould, polyester or other resin is fed in and pressure curing follows. While the replacement of part of the glass-fibre content by cotton or other organic fibre should clearly lower the prime cost of the preform, it would seem evident that the more important function of the organic fibre with its hydrophilic and fibrous nature is to assist in the homogenous dispersion of the glass fibre throughout the structure and to retain it so, a condition lacking in the normal wet lay-up process. Since also the preforming is followed immediately by a complete drying process, the latter would facilitate improved wetting by the resin. The magazine *Fortune* claims structures " stronger than steel " by this process and while this opinion may be regarded as an exaggeration and the result of journalistic enthusiasm, especially since a high organic fibre content can be employed, the structures are of engineering importance, even if only because of their improved homogeneity. The inventor, Mr. S. A. H. Young, is a director of Pressurform Co., Swarthmore, Pa., U.S.A.

Resin-Glass Advance.

DOGSBODDY.



Fluon Goes to Work

The manufacture, properties, fabrication and applications of p.t.f.e.

Fig. 1. Remote control of monomer purification at the Fluon plant of I.C.I. Plastics Division at Hillhouse, Lancashire.

UNDOUBTEDLY the most remarkable plastic material from the technical point of view yet to emerge into commercial production is polytetrafluoroethylene. The combination of properties it offers—resistance to chemical attack, high electrical values, high and low temperature resistance, and low co-efficient of friction, and " non-stick " property to an extent far greater than any other existing polymer—makes it unique in the range of materials the plastics industry offers to its customers, and it is scarcely surprising that many branches of science and technology have turned to p.t.f.e., as a means of solving hitherto intractable problems.

The production of both p.t.f.e. monomer and polymer, under the trade name ' Fluon,' is carried out in Great Britain by Imperial Chemical Industries Ltd., the manufacturing plant being located at Hillhouse, Lancashire. The capacity of the plant was recently increased from 20 to about 200 tons per year, which means that p.t.f.e. is now available in quantities such that we can expect to see a considerable extension of usage of this material in the near future. In the course of this article it is proposed to indicate broadly in which groups of applications this development is expected to take place, discussing also the material's manufacture, characteristics, and methods of fabricating.

Manufacture

The basic raw materials for the production of p.t.f.e. are the mineral fluorspar (calcium fluoride) and chloroform; from the former is obtained anhydrous hydrofluoric acid which when reacted with chloroform, yields difluoromonochlormethane, a gas boiling at — 40.8° C. This compound is known as Arcton 4, normally used as a refrigerant, and is brought to the site at Hillhouse in pressure containers, as a liquid. The first operation is vaporization of the Arcton 4, the resulting gas passing through pyrolysis tubes heated progressively up to 800° C., and where decomposition into tetrafluoroethylene and hydrochloric acid takes place. Temperature control and rate of gas flow determine the conversion percentage of Arcton 4 to tetrafluoroethylene. The exit gases, tetrafluoroethylene, hydrochloric acid, unconverted Arcton 4, and other fluorocarbons, etc., pass to a series of scrubbing units where the hydrochloric acid is removed. Final traces of water, resulting from the scrubbing, are removed by passing the gas through sulphuric acid.

The residual gases now undergo fractionation to obtain the pure monomer; this process removes the unconverted Arcton 4 which is recycled. The monomer then passes to the autoclaves, constructed of stainless steel, where polymerization takes place. In common with all similar reactions, carried out with the aid of catalysts, the process in the autoclaves is highly exothermic. Strict control must therefore be maintained.

The contents of the autoclaves comprise monomer, catalyst, and water, and the reaction conditions may be varied to produce either the granular or the dispersion polymers. In Fig. 1 is shown the main control panel. Behind the wall, on which the valves and instruments are mounted, are the autoclaves.

Adjacent to the autoclaves is the finishing room, seen in Fig. 2, and it is here that the final phase of manufacture of the granular and coagulated dispersion polymers is carried out. All the equipment is of stainless steel, to eliminate risks of contamination. For the granular material the procedure is to disintegrate the polymer from the autoclave to a uniform particle size, dry it in trays in specially constructed ovens, blend it and test, prior to packing for despatch.

Dispersion grades, which are sold in two forms, coagulated and fluid dispersions, are prepared as follows: for the former, the polymer from the autoclave is dropped into a coagulating vessel, and after coagulation is washed and then passed to a de-watering table. It is then dried on trays as is the granular product, sieved (see Fig. 3), tested and packed. The fluid dispersions are taken direct from the autoclaves to storage tanks,

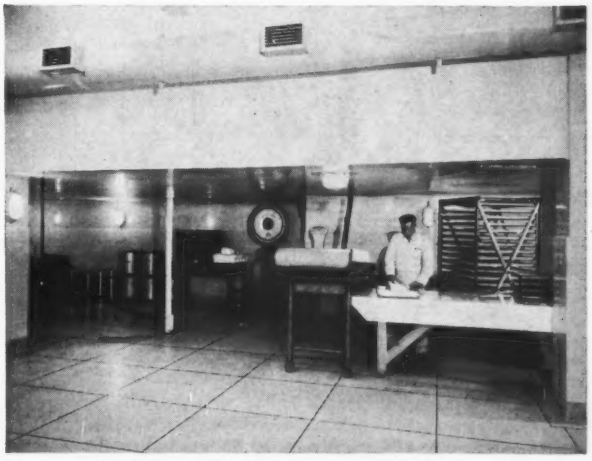


Fig. 2. Finishing room—drying granular polymer.

and from these to electro-decanting vessels (Fig. 4) where they are concentrated, subsequently being packed as liquids at the desired concentration.

Although the plant photographs shown here convey an impression of cleanliness and modernity (the plant is only just completed), they do not tell the full story. P.t.f.e., as will be seen later, is a material which must be fabricated under conditions absolutely free from dirt in any form. It follows therefore that in its manufacture it must be handled under conditions of extreme care. The Hillhouse plant operates under conditions which while not sterile in the surgical sense, nevertheless closely resemble that state, in that the most rigorous steps are taken to see that no contamination of the polymer occurs. These steps include air conditioning, the rooms also being under slight pressure so that no impure air can enter from without, special clothing for the work's personnel, specially prepared floors, tiled walls, and incessant cleaning.

Characteristics

The polymer is manufactured at Hillhouse in three basic forms; as a granular powder, for moulding and extruding; as coagulated dispersions, for extrusion or blending with silicone rubbers; and as aqueous dispersions for impregnating yarns, fabrics and porous metals, casting film, and preparing filled moulding powders. Since the method of fabricating the polymer depends broadly upon the form in which the customer buys it, it will be convenient to segregate the discussion on fabricating techniques under the above general headings.

Before so doing, however, the following general characteristics will be of interest, summarized as a table of properties, and compared with polythene, polystyrene and nylon. From this table it can be clearly seen where the superior properties of p.t.f.e. lie, and hence in which fields the major developments in p.t.f.e. usage have already taken place. The figures given are typical for moulded pieces but should only be taken as a general guide.

Comparison with other Materials

	'Fluon'	Polythene	Polystyrene	Nylon
Tensile strength (lb./in.²) ...	2,000	1,850	7,000	> 10,000
Elongation at break (%) ...	50–400	550	3	80–100
Young's modulus (lb./in.² × 10–⁵)	0.58	0.25	5.2	> 3.0
Impact strength (Izod) ...	4.0	> 3.0	0.3	2.5
Density (gm. cm.³)	2.2	0.92	1.05	1.14
Heat resistance (°C.) ...	250–300	100	95	150
Volume resistivity (ohm–cm.)	> 10^{19}	ca. 10^{19}	ca. 10^{19}	10^{15}
Dielectric strength (volts per mil, ☆ in. sheet)	500	1,000	1,000	400
Dielectric constant	2.0	2.3	2.5	4.0
Power factor	0.0001	0.0002	0.0002	0.02
Surface arc resistance ...	> 100 Does not track	> 100	> 100	> 100
Resistance to acids	Complete	Very good	Some attack	Attacked
Resistance to alkalis	Complete	Very good	Very good	Very good
Resistance to solvents ...	Complete	Resistant to most solvents	Attacked	Resistant to some solvents

The prime considerations involved in the exploitation of the material, from the standpoint of the fabricator, are its properties, which lie most outstandingly in its chemical resistance (only molten alkali metals and certain fluorine compounds at high temperatures affect it), its serviceability over a range of temperatures —80 to + 250° C., its low co-efficients of friction, its non-stick characteristics, its resistance to wetting, its outstanding dielectric properties and performance as a non-tracking electrical insulator, its non-inflammability, and finally its resistance to degradation by outdoor exposure.

The only property of an unfavourable nature is its high elastic deformation, a defect it shares with other thermoplastics, and this is capable of adjustment both by design and reinforcement.

Taking all its favourable properties into account, it enables

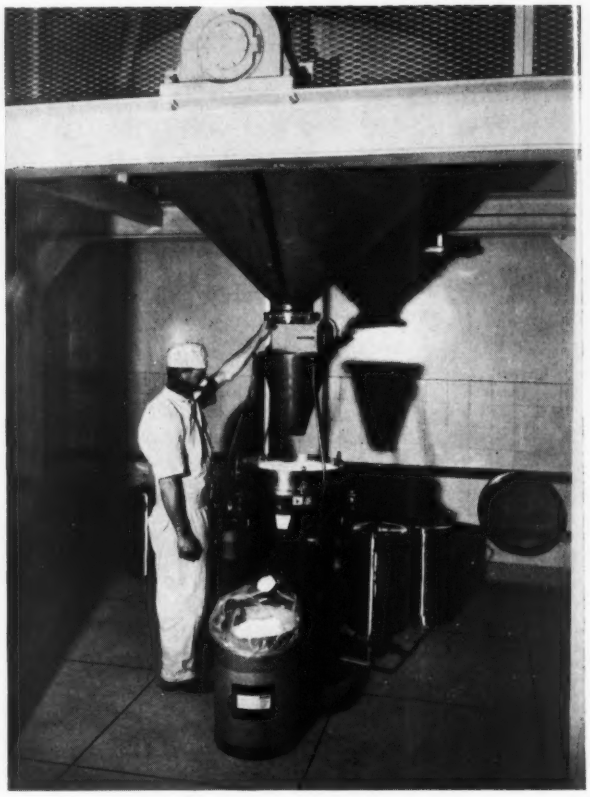


Fig. 3. Sieving and packing polymer.

important technical advances to be made, reduces maintenance costs, and simplifies design and production methods in a variety of ways, and already occupies a position of great importance in electrical, electronics, chemical, oil, and aviation engineering, as well as in paper making, textiles, and food processing.

Mention should be made here that when processing p.t.f.e., particularly at high temperatures, traces of vapour may be given off which if inhaled can produce unpleasant results. These can be avoided if reasonable precautions are taken in the form of efficient ventilation. In addition, because of the risk of contaminating tobacco, smoking should be banned in areas where p.t.f.e. is processed or p.t.f.e. components fabricated.

As will be noted in the following discussion of fabricating methods, p.t.f.e. demands a specialized technology. Since it does not melt and flow in the sense that other thermoplastics

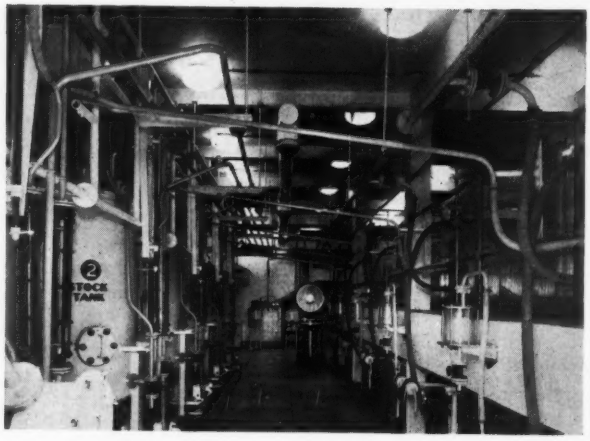


Fig. 4. A view of the electro-decanting apparatus.

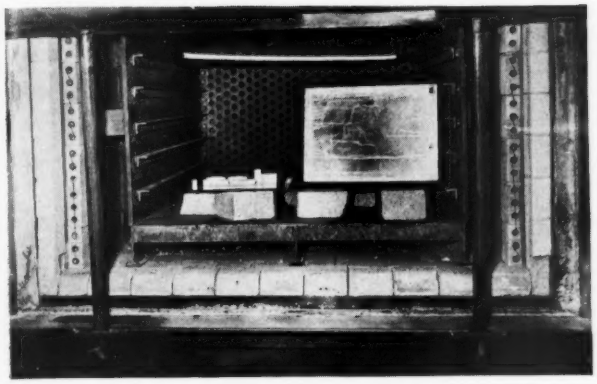


Fig. 5. Interior of a typical sintering oven.

flow, it cannot be processed in the same way. In addition, at 327° C. it undergoes a 25% volume increase, and since this temperature is some 33°–53° C. below its processing temperature, care is necessary if successful mouldings are to be made. That this somewhat intractable material has found a technology of its own is amply demonstrated by the following notes.

Fabricating Methods

Granular Polymer

Translucent to opaque in appearance, and white in colour, the granular polymer has been made in this country since 1947. Over the years considerable experience has been gained in handling the material, to the point where a general technology can now be said to exist. Basically it consists of a sintering process not unlike that used in powder metallurgy. This is employed since p.t.f.e. has poor flow properties and its behaviour at high temperatures is such that it is impossible to apply normal fabrication methods. The technique therefore is commonly to sinter in ovens at temperatures of 360°–380° C., the polymer having first been preformed by pressing at room temperature. At the sintering temperature of 360°–380° C. the particles coalesce thus making homogenous mouldings. Due to the 25% volume increase which occurs at 327° C., and which is reversible on cooling, it is not recommended that inserts be moulded into the material as is done with other thermoplastics. A typical sintering oven for p.t.f.e. is shown in Fig. 5.

Moulding. Here the polymer is moulded in a conventional hydraulic press, at pressures of 1 to 4 tons □ in. (Fig. 6). The powder is thus compacted to a preform with sufficient mechanical strength to permit handling. Preforms of this type are limited to simple shapes, having a minimum dimension of between 0.05 in. and 1 in. Such mouldings, if vertical dimensions are to be closely controlled, necessitate very careful powder weighing. Entrapped air is also avoided by closing the mould slowly. The compression ratio is between 3.2 and 3.6 to 1. The powder should be spread evenly, and mechanical levelling devices (an example is shown in Fig. 7) should be employed. Sintering follows at 360°–380° C. for periods of up to 90 minutes, depending on the size of the moulding, and as a result of this operation shrinkage occurs, of from 5–10%, at right angles to the direction of the moulding pressure. This shrinkage factor can however be controlled within certain limits by careful cooling, and a cooling cycle pattern for each type of moulding should be established. This cooling cycle also influences greatly the final mechanical properties. A harder, brittle product results from slow cooling, whereas rapid cooling gives a tougher and more ductile product. This latter technique, sometimes called " quenching," should not be employed for mouldings more than ¼ in. thick, since the strains imposed may cause cracking and surface sinking. For large mouldings having minimum dimensions greater than 1 in., pressure cooling is employed. Here the mouldings are left in the mould during the heating and cooling phases, the latter under pressure. The development of cracks due to shrinkage is thus avoided. The incorporation of metal inserts into a simple moulding is shown in Fig. 8.

Tubes and rods of limited lengths can also be made in this way, by the use of a die and plunger located in a press. Here the powder is compacted by the plunger, and the resultant tube or rod is smooth and can be handled. Sintering is carried out at 360°–380° C. as already described.

Impact Moulding. For certain mouldings, where major changes in section exist, or where deep-drawn recesses occur, it is necessary to carry out a rather more detailed moulding technique than that described above. Although having poor flow properties, p.t.f.e. can be caused to flow slightly, and this small margin is employed here to good effect. First a cold preform is made which is then sintered at 360°–380°C. It is then allowed to cool to just below the transition point, after which it is placed in a comparatively cold finishing mould and pressed. The pressure employed is a function of the shape, cross sectional area and the amount of draw, and will therefore vary from moulding to moulding. It is important that the moulding should be allowed to cool to below 250° C. before removal from the mould.

Extrusion. In addition to the technique described above for producing short lengths of rod and tube, p.t.f.e. may be extruded by means of semi-conventional extrusion plant, at temperatures of 400°–450° C. The screw length/diameter ratio should be normal, for plastic materials, but no compression ratio is required, since the process may be most truly described as continuous moulding. The granules are fed cold into the hopper, and the material is compacted as it moves through the barrel, which is water cooled. The heat is applied at the die, which may

Fig. 6. Moulding p.t.f.e. sheet at the works of the Edison Swan Electric Co. Ltd.

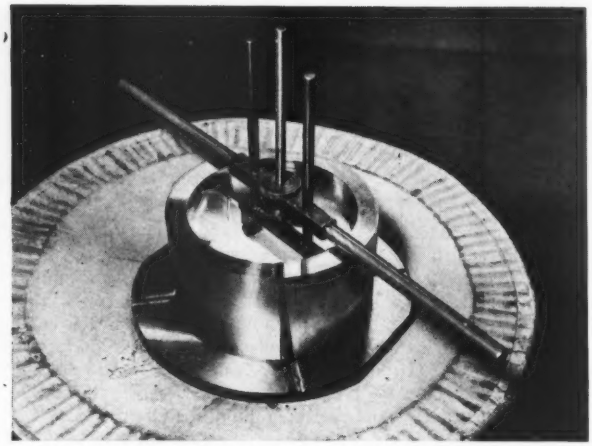


Fig. 7. A simple method of levelling the granules before moulding.

be regarded as the sintering zone. The experimental extrusion unit in the Technical Service and Development Laboratories of I.C.I. at Welwyn is shown in Fig. 9.

The rate of extrusion is, of course, slow by comparison with polythene or p.v.c., but it is nonetheless possible to cover wires and cables, and one American company has designed extrusion plant specifically for p.t.f.e.

As a general rule, the polymer is pre-sintered before extrusion, for 1½ to 2 hours, and then disintegrated, to avoid excessive compacting in the barrel.

Machining Block or Rod. Because of the ease with which p.t.f.e. can be machined, the manufacture of films, tapes and monofilaments for " wool " is a simple operation. Tape manufacture is shown in Fig. 10, and slicing rectangular sections in Fig. 11. If the stock has been sintered under pressure, thin film of the order of 0.001 in. thick upwards may be easily made, to tolerances of ±0.0005 in. As with the massive mouldings, the strength characteristics of such tapes can be substantially increased by heating to over 327° C., followed by rapid cooling. This process can be effected with the aid of two baths, the first

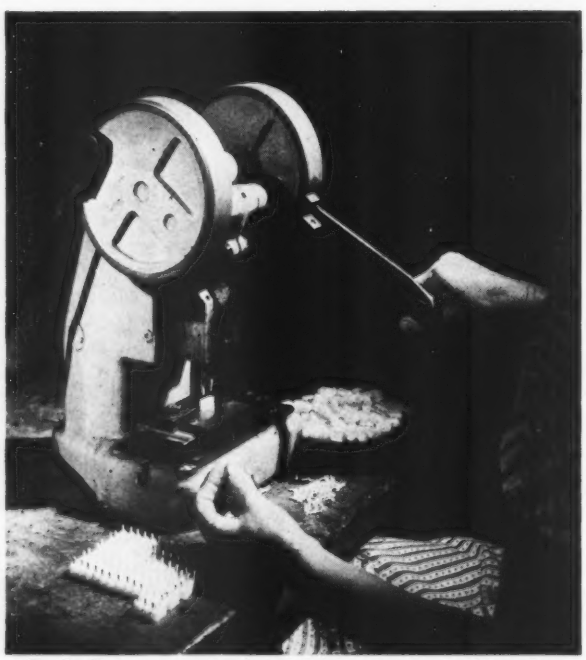


Fig. 8. Contact assembly of electronic components by Edison Swan Electric Co. Ltd.

Fig. 9. Set-up for the extrusion of tube and rod. Note extraction unit beside die-head.

of which contains a mixture of fused sodium and potassium nitrates, and the second water. The former is maintained at 400° C. The baths should be as close together as possible. Elongation of film quenched in this way is increased by up to 400%, and the apparatus employed is shown in Fig. 12.

Cold rolling is a process that can also be applied to film, tape and sheet. The effect is to increase the tensile strength substantially, with consequent reduction in elongation.

Films can also be welded by clamping the film, at pressure of about 150 p.s.i. for a few seconds, between two plates held at a temperature of 400° C. For thicker sections a scarf joint should be employed.

Finally, it should be stressed here that in all fabricating processes, scrupulous cleanliness is essential in view of the polymer's affinity for dirt. Any contamination seriously reduces the electrical characteristics, and in view of the high cost of the material, wastage must obviously be kept to the minimum.

Dispersions

An alternative polymerization method is by the dispersion process. Polymers so made are sold either as powders, which are subsequently lubricated by the fabricator immediately prior to use, or as aqueous dispersions. Both types have already established special outlets, and it is likely that the greatest tonnage uses will occur with the paste rather than the granular types.

Dispersion Powders. Special ram extruders have been built to handle these materials, for the production of thin wall tubes and for wire covering. A light petroleum or coal tar fraction is mixed with the powder, after which it is lightly preformed into a billet and placed in the barrel of the extruder. The ram forces the powder through the orifice of a cold die; the extrusion is then passed through an oven to flash off the lubricant, after which it is sintered. Extrusions are limited to sections up to ⅛ in., but the rate of extrusion is higher than for the granular type. Although the physical properties of granular and dispersion extrusions are generally similar, the latter have superior flex life.

The manufacture of tapes for cable and wire wrapping is also possible, by first extruding cylindrical rod sections, and afterwards calendering. In this case the lubricant is a white oil which is removed by passing the tape through a de-greasing plant.

Finally, it is possible to mill this type of polymer with silicone rubber, to improve tear strength and oil resistance.

Dispersion Fluids. The general purpose dispersion in water has been developed primarily for casting film, impregnating, and preparing filled moulding powders.

The technique for film casting is to flood the dispersion on to a polished surface, and warming to evaporate the water. The casting base and film are then placed in a sintering oven, after

which the film can be stripped off. This technique makes possible the production of films much thinner than by any of the other processes. A continuous process can also be operated.

Impregnating is carried out with glass fibre yarn, tapes and fabrics, by dipping the reinforcement into the dispersion, followed by drying. Such products can be used for slot liners and cable wrappings and braidings, or may be laminated to make insulating board and bases for printed circuits.

Filled moulding powders are manufactured by stirring finely-divided fillers into the dispersion and then coagulating by the addition of alcohol or acetone. The resultant sludge is then dried and disintegrated, and can then be processed in the same way as the granular polymer. Fillers such as graphite, asbestos, and finely-divided metal, etc., may be used and permit mouldings to carry greater loads without deformation. The properties of the filled mouldings will differ from those of unfilled material according to the type and amount of filler used.

Applications

In the four pages which follow, headed "Fluon in the Service of Man," some 30 photographs are reproduced demonstrating current applications of p.t.f.e. They form a logical conclusion to this report, since they illustrate the majority of the fabricating methods already described.

Remembering that until recently p.t.f.e. has only been produced at the rate of 20 tons a year, the diversity of applications shown in the following pages is remarkable. It is, however, possible to discern a clear segregation of applications, and these are more or less based on one or other of the outstanding properties of the polymer.

In the chemical field, bearing in mind the outstanding resistance of p.t.f.e. to attack by acids, alkalis, and organic solvents, it is used as gaskets, valve seatings, washers, both in the massive and film form. Here, too, it is used for the manufacture of piping for such liquids as H.T. peroxide.

For electrical applications, it stands in its own right as a material of outstanding merit; it further has the advantage of a high maximum service temperature, far in excess of any other thermoplastic. Hence its use for high duty cables in aircraft and any application where electrical characteristics must remain undiminished at elevated temperatures.

Its low coefficient of friction plus its anti-sticking properties means that baking rolls, confectionary plant and the like can be treated to vastly reduce this problem. It may be said that in this

Fig. 10. Veneering tape from a block at the works of Edison Swan Electric Co. Ltd.

branch of application, only the surface of the subject has yet been touched.

Undoubtedly the following pages will stimulate considerable interest in new applications. We therefore publish here the full addresses of all the fabricating organizations mentioned.

Bel Sound Products Co., Marlborough Yard, London, N.19; Bowden (Engineers) Ltd., Victoria Road, London, N.W.10; British Insulated Callenders' Cables Ltd., 21 Bloomsbury Street, London, W.C.1; Crane Packing Ltd., Trading Estate, Slough, Bucks.; Henry Crossley (Packings) Ltd., Bolton, Lancs.; Dalau Specialised Plastics, Clacton-on-Sea, Essex; The Edison Swan Electric Co., Ltd., 155 Charing Cross Road, London, W.C.2; Fothergill & Harvey (Research and Development) Ltd., Littleborough, Lancs.; Kent Mouldings, Footscray, Sidcup, Kent; Richard Klinger Ltd., Sidcup, Kent; McMurdo Instrument Co., Ltd., Ashtead, Surrey; Nobrac-Carbon Ltd., Commerce Way, Lancing, Sussex; Sorensen Bakery Equipment Ltd., Raby Street, Manchester, 4; Superflexit Ltd., Trading Estate, Slough, Bucks.; The Telegraph Construction & Maintenance Co., Ltd., Christchurch Way, London, S.E.10; James Walker & Co., Ltd., Woking, Surrey.

Fig. 11. Slicing rectangular sections of p.t.f.e. (Edison Swan Electric Co. Ltd.).

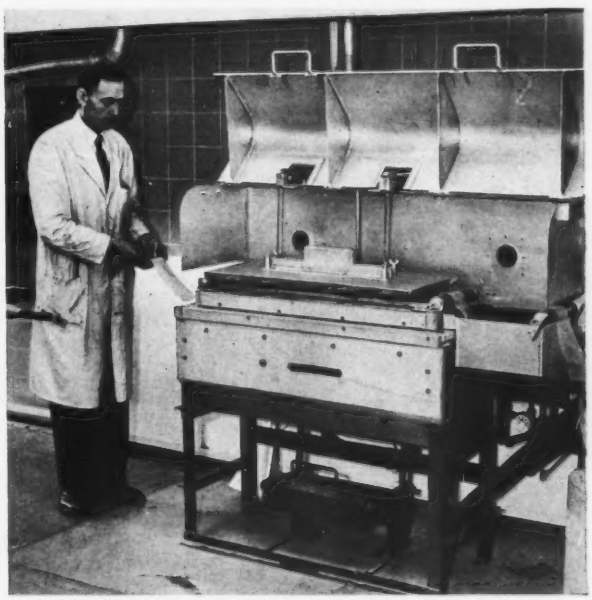
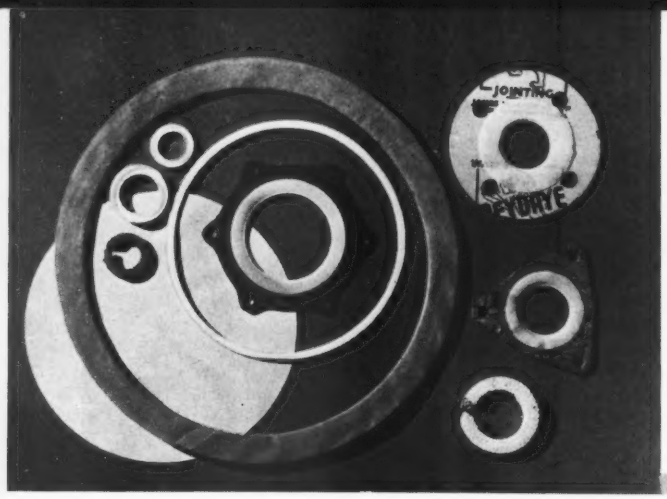
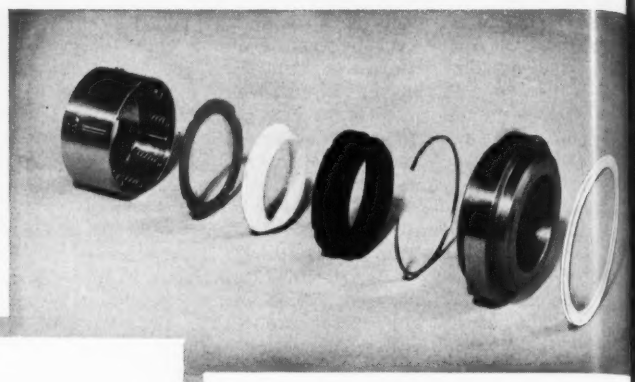


Fig. 12. Quenching apparatus for p.t.f.e. film, seen here at I.C.I.'s Plastics Division, Welwyn.



(Left) Fluolion braided emulsion white and blue packings disc and solid gaskets made from Fluon by James Walker & Co. Ltd.

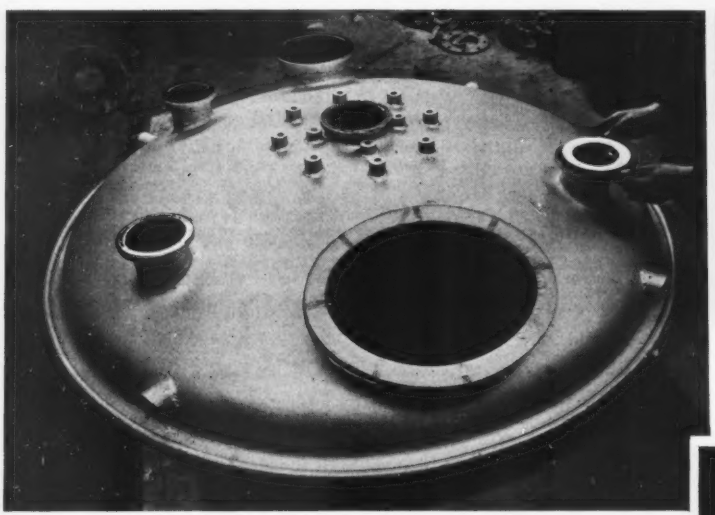
(Below) Corrosion resistant seal units incorporating p.t.f.e. rings made by Crane Packing Ltd.



Plastics in the Service of Man

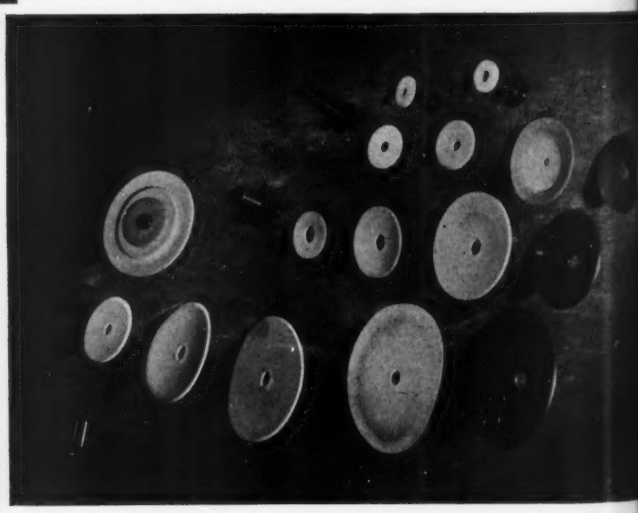
72. Polytetrafluoroethylene

A list of trade names and companies mentioned in this review, with full names and addresses appears on page 117



(Above) Fluolion envelope gaskets manufactured by James Walker & Co. Ltd., being used to seal glass lined tanks.

(Above) Seals, rings, gaskets, packing sleeves and lip rings of p.t.f.e. made by Richard Klinger Ltd.

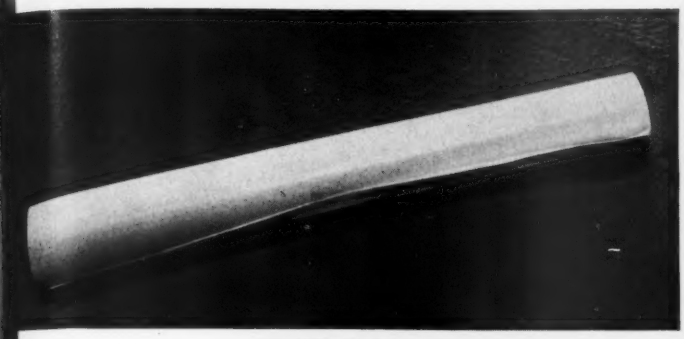


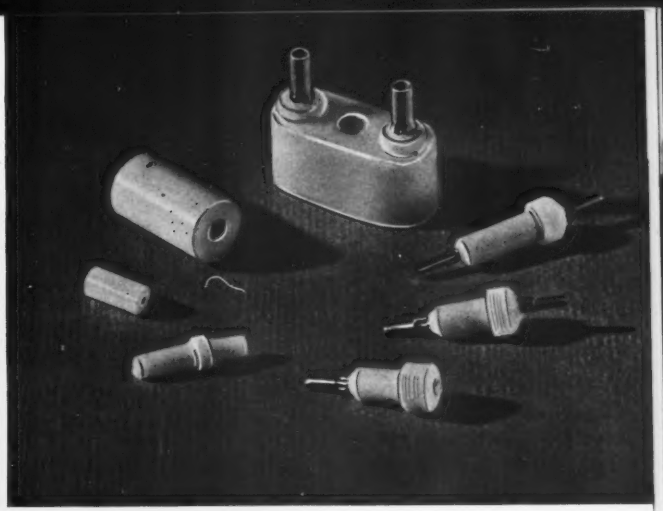
(Above) Fluon washers made by Crane Packing Ltd. for repairing small holes in glass lined tanks.

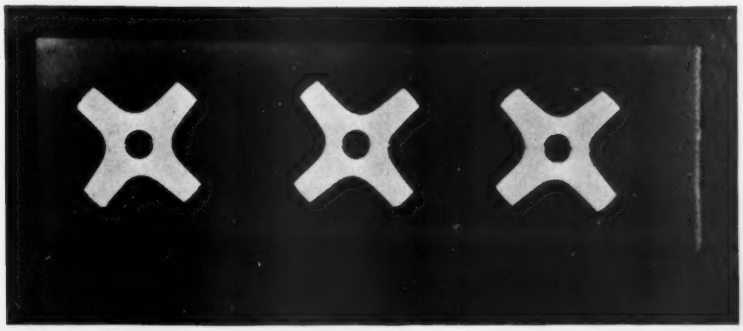
(Left) Packing sleeves, rings, lip rings and a flanged moulding made by Richard Klinger Ltd.

(Right) Fluon electronic components, manufactured by The Edison Swan Electric Co. Ltd.

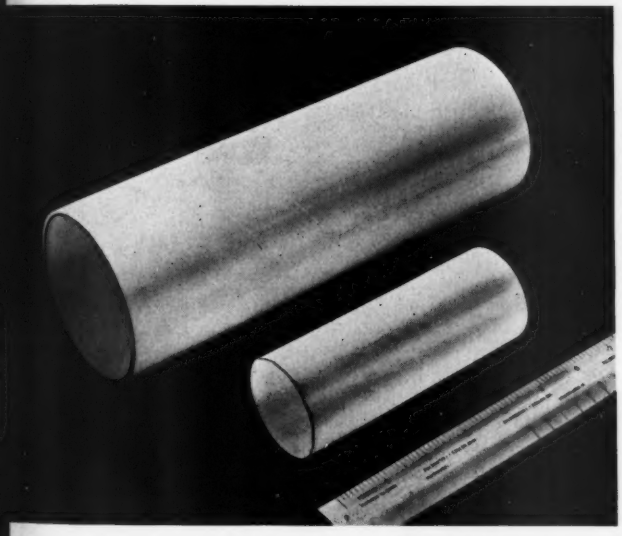
(Below) Glass fibre fabric coated by Fothergill & Harvey (Research and Development) Ltd., with p.t.f.e. dispersion.







(Left) Moulded insulators in Fluon produced by Kent Mouldings Ltd.

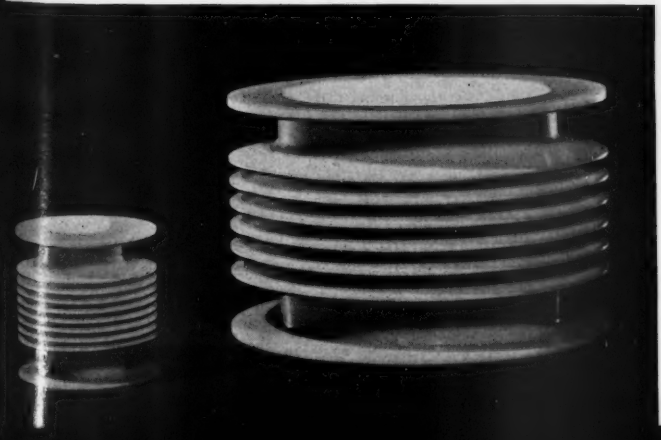


(Above) Fluon cylinders manufactured by The Edison Swan Electric Co. Ltd.

(Above) Valve holders and flying leads made by the McMurdo Instrument Co. Ltd.

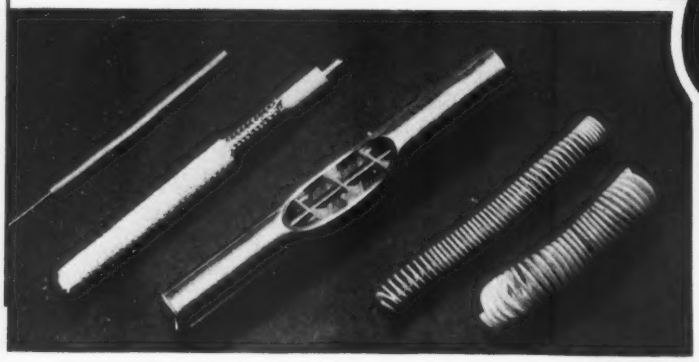
(Above) Evaporating dish for laboratory use moulded in Fluon by The Edison Swan Electric Co. Ltd.

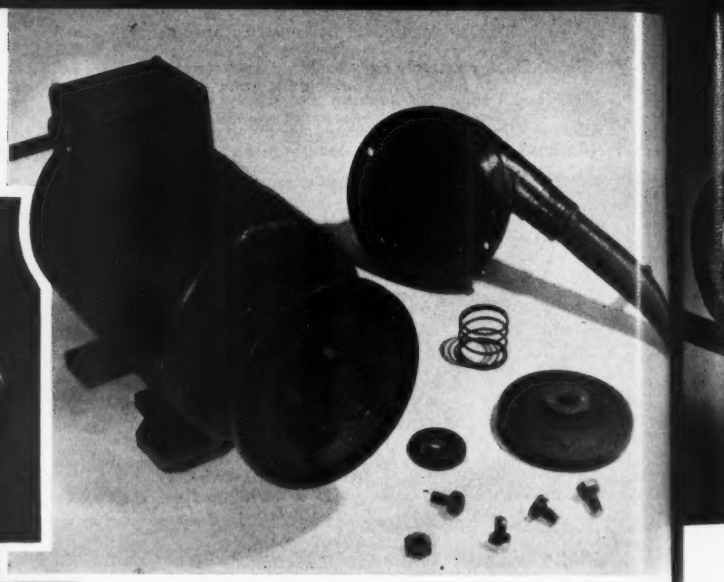
(Left) Flexible jointing or bellows in Fluon manufactured by Crane Packing Ltd.



(Right) Gland ring manufactured by Nobrac-Carbon Ltd., in carbon impregnated with Fluon and fitted in an electric pump.

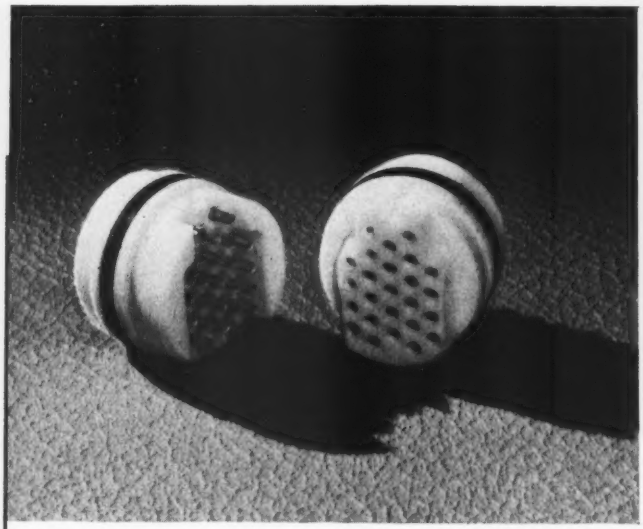
(Below) Cables and wires covered in Fluon by The Telegraph Construction and Maintenance Co. Ltd.

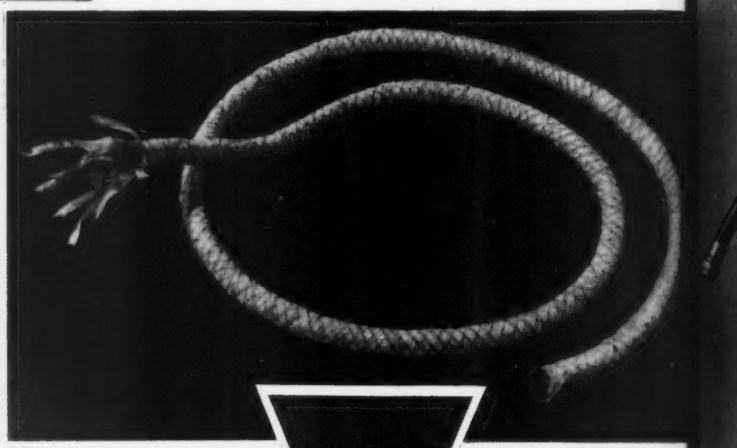




(Below) Multi-way plug and socket, made by The Edison Swan Electric Co. Ltd., with Fluon body insulation.

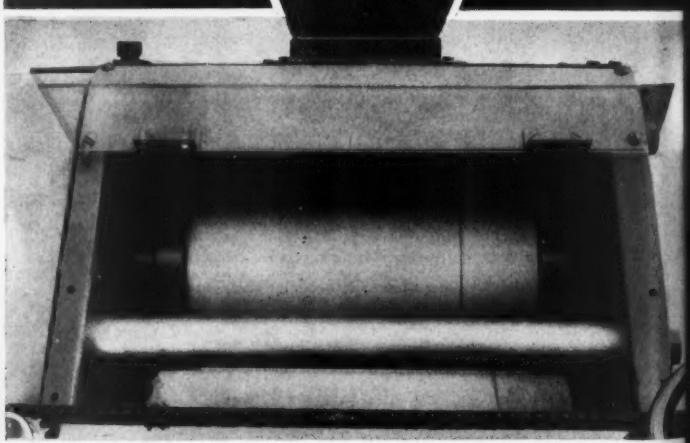
(Below) Fluolion braided packings manufactured by James Walker & Co., Ltd.

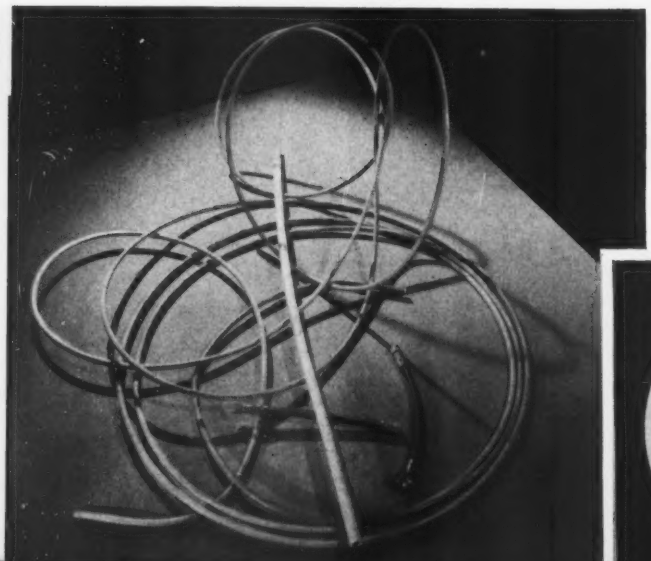




(Right) Front of a bakery machine made by Sorensen Bakery Equipment Ltd., showing the Fluon covered rollers used to prevent dough sticking.

(Below) Flexible tubing and reinforced pipe units made from Fluon by Bowden (Engineers) Ltd.

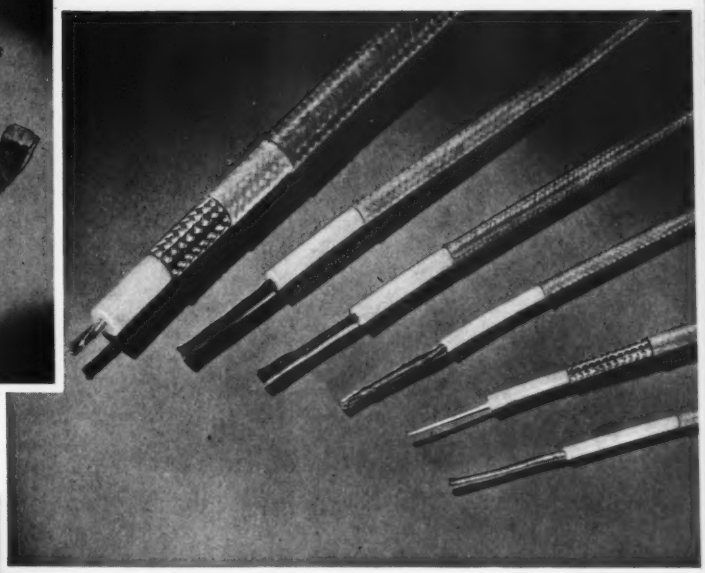


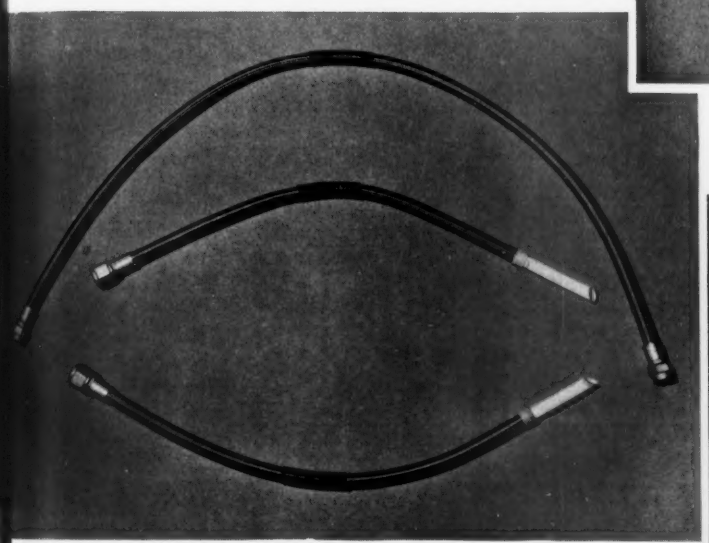


(Below) Electrical components produced in Fluon by Bel Sound Products.

(Above) Braided gland packings in asbestos crysolite impregnated with p.t.f.e. and a pure p.t.f.e. packing manufactured by Henry Crossley (Packings) Ltd.

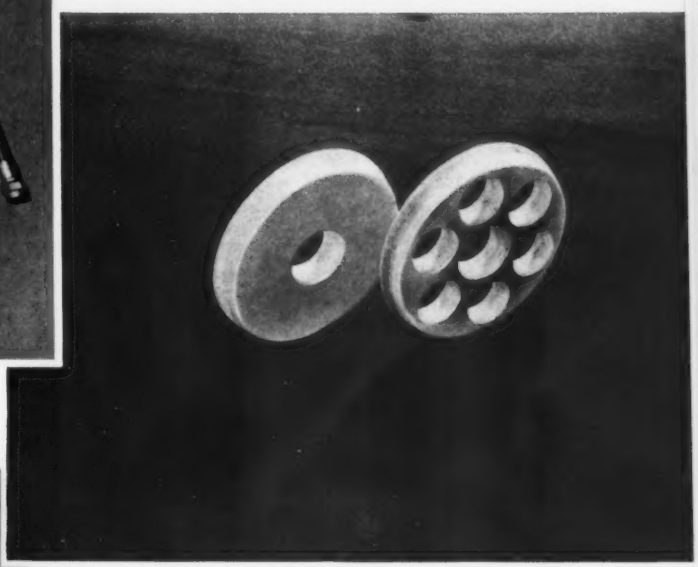
(Below) Fluon insulated cables, manufactured by British Insulated Callenders' Cables Ltd., used where high operating temperatures are encountered and very high frequency electrical insulation is required.





(Above) Reinforced p.t.f.e. tubing manufactured by Superflexit Ltd.

(Below) Fluon mouldings for chemical plant manufactured by Crane Packing Ltd.



(Above) A selection of Fluon caps manufactured by Crane Packing Ltd. to fit on earthenware valves. Incorporated in the base of the exterior is a bevelled valve seating.

(Below) Electrical and electronic insulators and components made by Dalau Specialised Plastics made from p.t.f.e.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Collapsible Plastic Bath

SIR,—We are receiving inquiries for a collapsible plastic bath, which retails at 78s. 6d.

We shall be pleased to receive any information you may have regarding the manufacturer of this bath.

CO-OPERATIVE WHOLESALE SOCIETY, LTD.
Hardware Department,
P.O. Box 53,
1 Balloon Street,
Manchester, 4.

Perspex Letters

SIR,—I wonder if you are in a position to put me in touch with a manufacturer of Perspex moulded letters.

R. MIDDLEMISS.
37 Cypress Gardens,
Blyth,
Northumberland.

Foamed Plastics

SIR,—We wish to contact a firm manufacturing foamed plastic sheeting ½ in. thick, either in large sizes 36 in. or 54 in. square, or preferably in roll form 36 in. or 54 in. wide.

S. G. YOUNG.
154/156 Blackfriars Road,
London, S.E.1.

Plastic Cigarettes

SIR,—Last year I purchased an imitation cigarette made in plastic while on holiday on the Continent.

I am desirous of purchasing a quantity of these and would like to know if you know the whereabouts of any in this country. If you do not, can you give me some idea what the smallest quantity I could have made would be. I had in mind 1,000.

H. G. PILLING (CHEMIST) LTD.
10 Brooklands Road,
Brooklands,
Cheshire.

Acetate Film

SIR,—We are interested in obtaining supplies of acetate sheeting 1/1000 in. in reels 40 in. wide, and we would be obliged if you would advise names and addresses of manufacturers in the United Kingdom.

ABEL, LEMON & CO. PTY., LTD.
109 Fenchurch Street,
London, E.C.3.

Moulder Required

SIR,—Having in mind an article to be moulded in plastic for household, office and factory use and which, to my knowledge is not on the market at the moment, I wondered if you could supply me with the names and addresses of one or two firms who undertake to purchase ideas for products which they can manufacture and market, providing such ideas are acceptable.

I do not think that the article I have in mind is patentable.

JEFFREY R. JONES.
49 Blythswood Street,
Liverpool, 17.

Plastic Globes

SIR,—We are seeking to obtain a number of plastic globes approximately 12 in. in diameter which could be illuminated by electric bulbs.

COUNTRY INVESTMENTS LTD.
Cupola House,
Dover Road,
Folkestone,
Kent.

Flame Spraying

SIR,—We would be grateful if you could let us have the names and addresses of any firms specializing in the spraying of p.v.c. by flame gun, or other means.

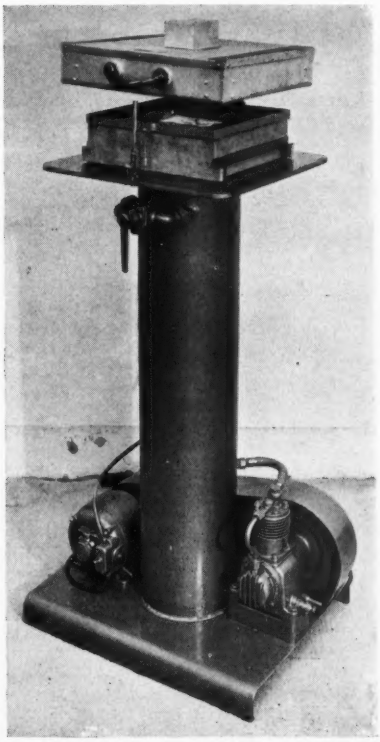
AEROPREEN PRODUCTS LTD.
Bellfield Approach,
High Wycombe,
Bucks.

A New Vacuum Forming Machine

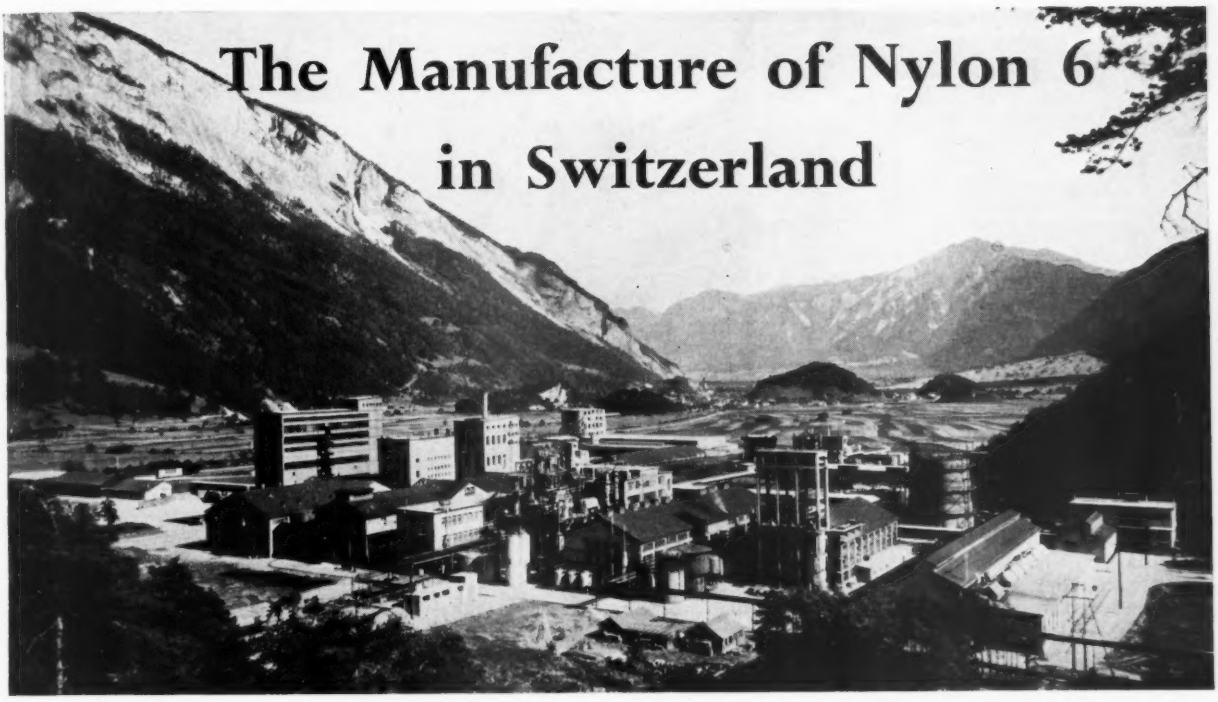
ONE of the more recent plastic forming techniques introduced into this country and one which received a good deal of publicity at the time, is vacuum forming. This technique has now established itself as a definite section of the plastics industry and its use is common in the production of displays, packages, toys, and refrigerator parts. A large measure of its success has been due to the continued enterprise of the machine manufacturers in bringing out more efficient and more versatile vacuum forming machines instrumented to make their operation almost fully automatic and foolproof. Admirable and necessary as this is, it has of necessity increased the cost of the machine. For the fabricator considering the advisability of offering vacuum forming as a service to his customers he must invest a considerable sum in machinery before he can assess, by samples, the market he hopes to enter. For the fabricator already established in this market the use of an expensive and complex machine to produce two or three prototype models is uneconomic and unsatisfactory. Bearing these points in mind it was with considerable interest that we were able to examine a new, inexpensive, and simple vacuum forming machine designed for use in the production of prototypes and samples.

As can be seen from the illustration the machine has a clean appearance and occupies comparatively little floor space. The mould area is 12 in. by 12 in. and depth of draw of 9 in. can be obtained after adjusting the heater clearance. Power for the evacuating pump is supplied from a ⅓ h.p. single-phase electric motor. The vacuum cylinder is in effect the central column of the machine and is of ample capacity for forming to the maximum depth and area. The heater is of 1.25 Kw. capacity and is swung clear of the mould box when not required. A simple screw adjustment can be made to its supporting pillar to vary its height according to the depth of draw required. The whole machine is of very sturdy construction and weighs approximately 200 lbs. In an endeavour to keep the price commensurate with application and at the same time producing a reliable machine the manufacturers have decided that timers and pressure gauges and other instruments are unnecessary trimmings and that an operator entrusted with the production of samples should be sufficiently skilled to work without them.

Further details of this machine, which it is anticipated, is the forerunner of a series, can be obtained from the designers and manufacturers, M. L. Shelley & Partners, Ltd., 280 Earls Court Road, Kensington, London, S.W.5.



The Manufacture of Nylon 6 in Switzerland



We recently visited the manufacturing plant of Holzverzuckerungs A.G., Switzerland. The following is an account of the synthesis of nylon 6. The second part of the article, to be published next month, will discuss the testing properties and applications of this material.

ONE hundred and forty kilometres south-east of Zurich, and close to the high alps bordering Austria and Italy lies the village of Domat-Ems. On the outskirts of this ancient township is situated one of Switzerland's most modern chemical plants, the first buildings of which were erected in 1941. The company, Holzverzuckerungs A.G., was formed to produce alcohol from wood, by the decomposition of cellulose to hexose, this being converted to ethyl alcohol by fermentation. From this initial process many others have been originated, one of which is the manufacture of nylon 6, with which we are primarily concerned here.

Of the many nylons available today as fibres, monofilaments, foils and moulding and extrusion compositions, nylon 6 is the most widely manufactured in Continental Europe. This is in contrast to Britain and the U.S.A., where nylon 66, a product of hexamethylene diamine and adipic acid, is usually manufactured. The raw material for nylon 6 is not necessarily confined to one type; in the case of the Swiss product, the raw material is phenol, and it is therefore with the phenol that we shall commence the description of the manufacture of "Grilon," Holzverzuckerungs' trade name for their brand of nylon 6.

Phenol is imported into Switzerland from various sources, Germany, Benelux countries and Britain. Because of irregularities in properties occasionally encountered in gas-works phenol, it is customary to employ the very pure and uniform synthetic product. On arrival it is tested for purity and stored preparatory to use.

An electrolysis plant makes available on the site a ready supply of hydrogen, which is introduced into the hydrogenation system with the phenol, converting the phenol catalytically to cyclohexanol, according to the equation shown in Fig. 1a.

After distillation the cyclohexanol is then dehydrogenated to cyclohexanone (Fig. 1b), which leaves the ring compound with an oxygen atom attached by a double-bond linkage, and is a continuously recycling process. A view of the plant is seen in Fig. 2.

The cyclohexanone is distilled to purity and is then reacted with hydroxylamine sulphate, also produced on the site at Domat-Ems. This results in the formation of cyclohexanone-oxime, according to the equation shown in Fig. 1c, and liberation of sulphuric acid which is neutralized with aqueous ammonia. The control section of this part of the plant is seen in Fig. 3.

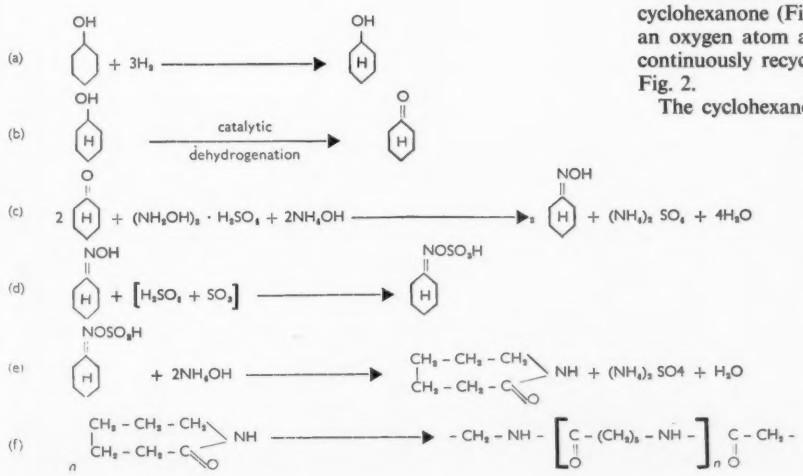


Fig. 1. Sequence of chemical reactions employed in the manufacture of "Grilon."

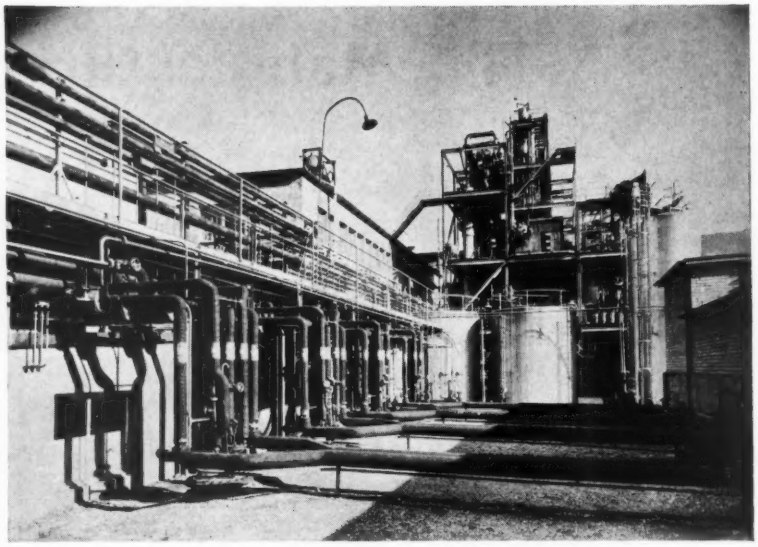


Fig. 2. Plant for manufacture of cyclohexanol and cyclohexanone.

By separating the cyclohexanone-oxime from the aqueous ammonium sulphate, the latter undergoes an evaporation process, yielding ammonium sulphate suitable for sale as a fertilizer.

The next step is the rearrangement of the structure of the cyclohexanone-oxime, effected by reaction at elevated temperatures with sulphuric acid containing free sulphur trioxide (Figs. 1 (d) and 1 (e)).

In the reaction set out schematically, the cyclohexanone-oxime is re-arranged to ε-caprolactam which then undergoes a series of purification processes, to yield a pure, crystalline hygroscopic material. The poly-condensation process is indicated in the equation shown in Fig. 1 (f).

A diagrammatic representation of the processes described above is given in Fig. 4.

Caprolactam has been polymerized for many years, usually by the batch process, in vessels of capacities ranging from 25 to 500 gallons. It is possible, however, to polymerize the material continuously, and both methods will be described here.

Batch Polymerization

The reaction vessels employed are of the familiar pattern, comprising a pot fitted with a spade stirrer, and jacketed for Dowtherm circulation. Into the pot are charged caprolactam, water, acting as a catalyst, and a stabilizer, the function of which is to limit the molecular weight. The contents are under slight pressure from a nitrogen blanket, and this latter must be 99.99% pure. Any oxygen present in the gas would seriously affect the reaction and the product. The reaction takes place at about 250° C. for a period of 12 hours. The condensation process is continued until an equilibrium is reached which consists of about 90% polymer and 10% low molecular weight products.

At the completion of the reaction, the polymer together with the other contents of the pot are forced out through the exit cock at the base of the vessel by nitrogen pressure. A view of the polymerizing plant is seen in Fig. 5.

Continuous Polymerization

This method of obtaining the polymer has certain advantages, apart from the purely economic, such as very good uniformity of the polymer and three plants are in operation at Domat-Ems. The procedure is to maintain a reservoir of caprolactam, water and stabilizer, used to feed continuously the reaction columns, which is run at approximately 250° C.

A continuous stream of polymer leaves the reaction column, and is cooled, cut, washed, dried, extruded, chipped and packed. The washing process is of importance here to remove any residual low-molecular weight material, and ensures a consistency of product. The extracted material, comprising mainly monomers, is fed back to the distillation plant referred to above.

It is also important to note here that the drying process, which is carried out in rotary ovens, brings the moisture content of the granules of polymer to less than 0.2%.

From both methods of polymerization, batch and continuous, over 3,000 tons of polymer are produced annually at Domat-Ems, predominantly from the batch process.

From this total annual production, the polymer is channelled into three categories of use: (1) Conversion into granules, for moulding and extrusion grades; (2) conversion into monofilaments; (3) conversion into yarns

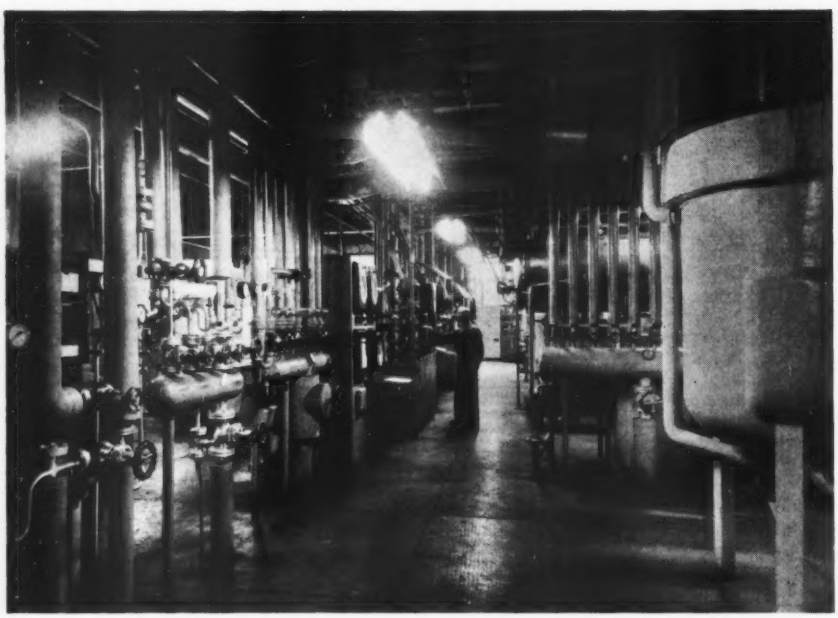


Fig. 3. Control panel for conversion of cyclohexanone to cyclohexanone-oxime.

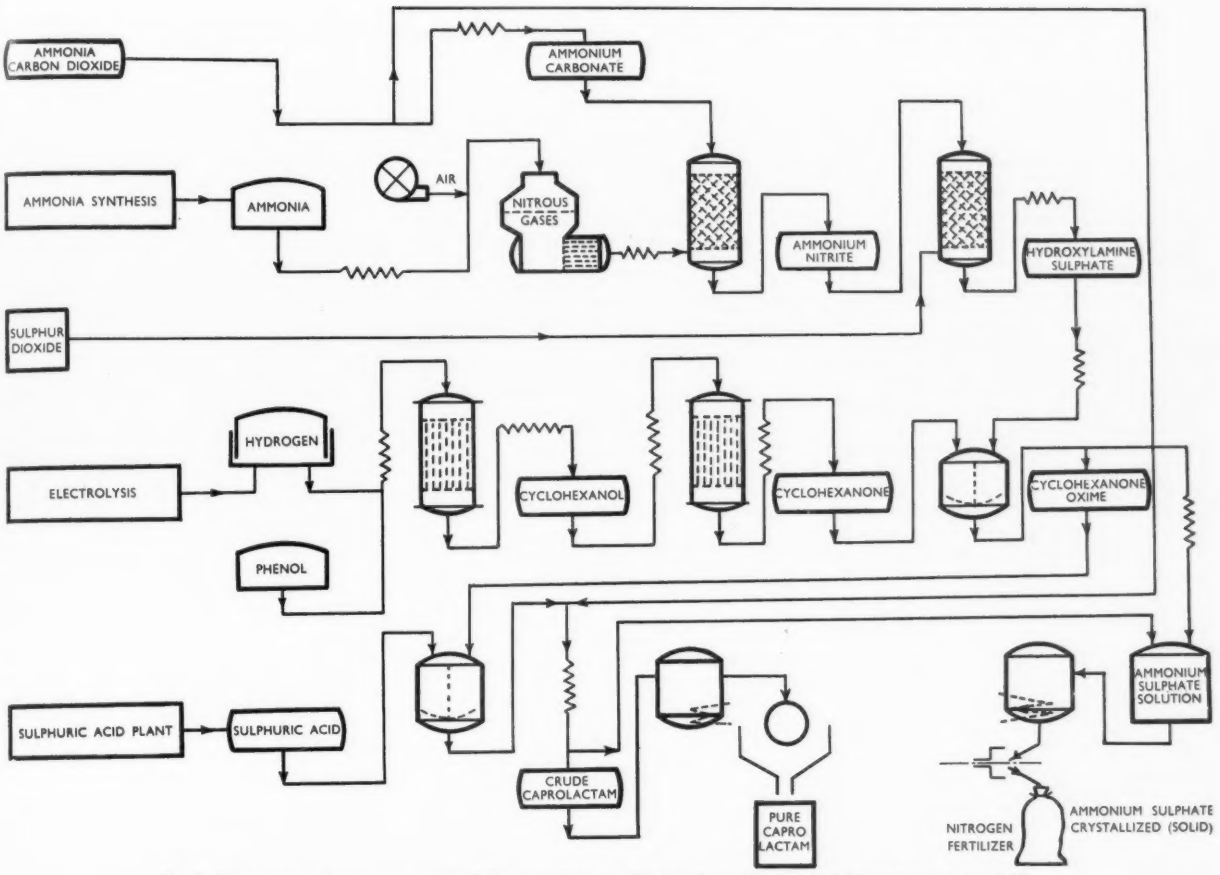


Fig. 4. Diagrammatic representation of the manufacture of nylon 6 carried out by Holzverzuckerungs A.G.

for eventual use by the textile industry. This last conversion process is beyond the scope of the present article.

Manufacture of Moulding and Extrusion Granules

The polymer, as noted earlier, is drawn from the reaction vessel, as a thick monofilament. On cooling to the solid phase it is disintegrated to uniformly small chips of a size approximately $\frac{1}{12}$ in. square, and having a bulk density of 44 lb. per cubic foot. Colours are incorporated (more than 20 standard colours are available) by dry blending followed by extrusion blending and chipping. Low molecular weight constituents are then washed out and the chips are then dried to a moisture content of less than 0.2%. The chips are then packed in air-tight tins.

Rods for customer fabrication are also made at Domat-Ems of diameters from $\frac{1}{16}$ in. to 10 in. Manufacture is by a patented extrusion process from a grade of Grilon having a very high molecular weight. Rods made in this way have many applications, and are specially useful where injection moulding would be uneconomical because of small runs. They are also used in the manufacture of prototypes, and very large articles having large wall thicknesses, such as heavy gears and bearings.

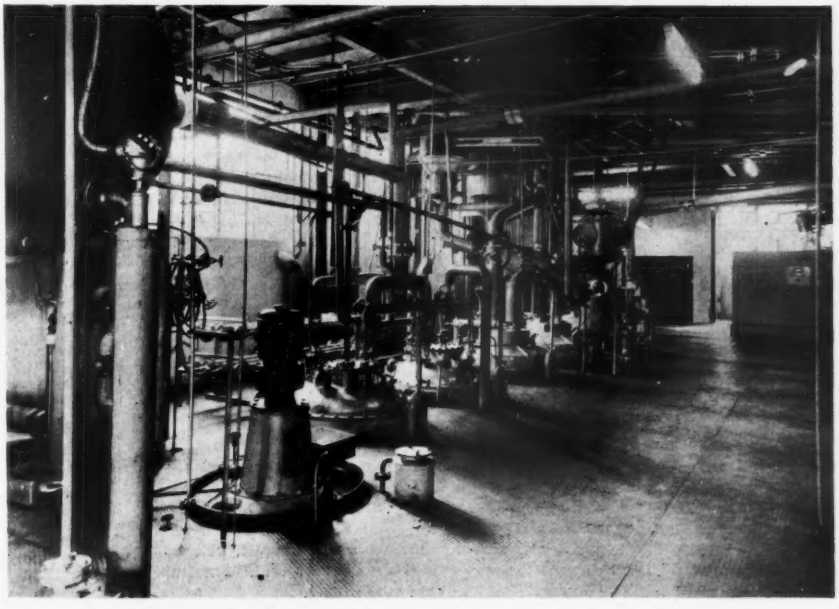


Fig. 5. Polymerization of caprolactam at Domat-Ems.

(Part 2 of this article will be published in the May issue of *Plastics*).

Polymers from Oxa*cyclo*butanes

*A summary of a paper read before the Plastics and Polymer Group of the Society of Chemical Industry on March 26, by Mr. D. J. H. Sandiford, of the Plastics Division, Imperial Chemical Industries Ltd. The author discusses the laboratory scale evaluation of the polymer from 3 : 3—bischloromethyloxa*cyclo*butane. Mr. A. C. Farthing of the Dyestuffs Division, Imperial Chemical Industries, Ltd., presented a paper at the same meeting on the chemistry of oxa*cyclo*butane polymers.*

THE author introduced the paper by noting that its main purpose was to outline the methods by which a new polymer could be evaluated, although the polymer under discussion was, in itself, of considerable interest, being of a novel and unusual structure. The object would therefore be to delineate the steps taken to characterize the polymer from the technological point of view, defining the features of the material which would determine the details of the fabricating processes, and which would also be relevant to its end uses. This discussion on evaluation philosophy would be followed by an illustration of certain aspects of the general behaviour of high polymers, e.g. the correlation of changes in electrical behaviour with those in mechanical behaviour.

Dealing specifically with the characterization of the polymer, the author outlined the known information at the outset of the investigation. This information included an indication of the melting point (about 180° C.), that it was partially crystalline, and that the melt viscosity, measured by penetrometer, was a few thousand poises at 260° C. This last item suggested that the polymer would be in the polythene rather than the nylon class from the moulding technique point of view. In fact, it proved simple to obtain good quality compression mouldings in the form of thin plates at 195° C., and it was upon the polymer in this form that the bulk of the investigation was carried out.

The first property to be evaluated was the flow behaviour, using a capillary penetrometer. Certain deductions were made including predictions on conditions necessary for fabrication processes, a relative scale of molecular weight, and the stability of the polymer in the melt.

A modified Barcroft apparatus was employed to measure the oxidation of the unstabilized polymer, at 78° C. and 100° C. This investigation showed that the oxygen uptake of the polymer at 100° C. in air was substantially lower than for polythene, the more marked features being apparent, of course, at 100° C. As with polythene, it was found possible to reduce the oxygen up-take by the addition of small quantities of antioxidants.

Volume-temperature relationship was established by means of a mercury-in-glass dilatometer, over the temperature range—30° C. to +210° C. This investigation permitted, inter alia, a study of the temperature range over which melting occurs.

One line of investigation stemming directly from the above was the study of the crystallization kinetics, since hysteresis effects observed when making the specific volume measurements indicated that rates of crystallization and induction periods would be measurable over a wide range of temperature below the melting point. This was in fact found to be so, and various techniques were used to study the crystallization behaviour; much use was made of density gradient columns with which a variety of simple and elegant measurements can be made. Results from this investigation confirmed the picture given by the dilatometric data, and served to establish certain facts of importance to processing the polymer. Amongst these were the conditions for injection moulding highly crystalline mouldings, for which a mould temperature near 100° C. would be required. Quenching to 0° C. would produce amorphous polymer, provided, of course, that a sufficiently thin sample were used to ensure good heat transfer. An instance of the practical importance of such an operation would be the production of amorphous film for subsequent biaxial stretching and heat setting.

X-ray crystallography indicated the existence of two crystal forms, yielding quite different X-ray diffraction patterns; the α form was found to result when the polymer was cooled slowly through the crystal melting point, whereas the β form was produced by allowing the quenched amorphous material to crystallize by raising its temperature above the glass transition temperature (7° C.). Depending upon the moulding conditions, one form or a mixture of both crystal forms were found. These two forms were found by hot-stage microscopy to melt over different temperature ranges, and to have different crystal habits.

The author then discussed the elastic properties, and after considering the complex dynamic modulus, described the evaluation of the tensile properties, employing compression moulded sheet. The experiments were carried out over a wide range of temperatures at a strain rate of 3% per sec. To illustrate this section of the paper, a table was given showing a comparison of the mechanical properties of the oxa*cyclo*butane polymer with nylon 66, high and low density polythene, polymethyl methacrylate, and rigid p.v.c.

The electrical properties were then discussed, followed by a section devoted to miscellaneous properties, embracing water absorption which was found to be negligible in terms of effect on dimensional stability and electrical properties, followed by resistance to environmental cracking, hydrolytic stability and flammability. The polymer successfully withstood the accelerated cracking test developed by the Bell Telephone Laboratories, and due to the high percentage of chlorine in the molecule (46%), burned only with difficulty.

The author's conclusions were as follows:—

"The new oxa*cyclo*butane polymer has useful electrical and mechanical properties over a wide range of temperature, especially between 20° and 120° C. where the electrical properties are very similar to those of polyethylene terephthalate. Its potentiality as an oriented film and as an injection moulding material is good: on all counts its negligible water absorption and resistance to hydrolysis are remarkable."

A polymer of apparently the same constitution has been developed in the U.S.A. by the Hercules Powder Company; quite recently some of the properties and uses of this polymer (called "Penton") have been described in the technical literature, particular attention being devoted to possible extrusion and injection moulding applications.

U.S. Aircraft Industry is Big Market for Plastics

A short report from the American "Journal of Commerce," issue dated March 19

A FAST-GROWING market for plastics is developing in the aircraft manufacturing field, Robert Prescott, president, Flying Tiger Lines, reported at the first day's session of the 20th annual conference of the Society of the Plastics Industry.

Evidencing the rapid growth in the use of plastics in aircraft, Mr. Prescott noted that during the past 10 years aircraft manufacturers have trebled their use of plastics.

Lockheed Aircraft, for example, he said, uses about $1 million of raw plastics materials a year, with the manufactured value at $10 million to $15 million.

Typical uses cited by the aviation industry executive include: paper-faced plastic impregnated floors; plastic cargo liners in cabins, and in electrical harness and controls.

Weight savings compared with aluminium, said Mr. Prescott, exceed 50%, and the plastic material, he added, withstands rough loadings.

As evidence of the increasing attention in the plastics industry in the Pacific Coast market, it was noted by plastics firms here that the S.P.I. conference is being held on the Pacific Coast this week for the first time in the society's history.

Plastic industry representatives from various parts of the United States as well as from foreign countries attended the four-day meeting, with total registration expected to approximate 1,000.

Over 500 companies in the West are now processing plastics for such applications. California reinforced plastics output, for example, now exceeds over $100 million yearly, principally for aircraft, military, and structural uses.

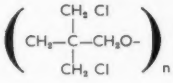
Spokesmen at the conference estimated that plastics consumption will parallel the continuing growth of the West Coast industrial area. Los Angeles has moved from nineteenth to third position among major U.S. industrial cities, ranking in the top third of industries such as aircraft, refrigeration and heating, electronics, oil field machinery, and automobile assembly.

New American Polymer from Pentaerythritol

We give below some details of the new American polymer Penton made by treating pentaerythritol with hydrochloric acid and caustic soda and polymerizing with boron trifluoride. We have been asked to state by the manufacturers, Hercules Powder Company Inc., that this polymer is in its development stage and is only available in the United States at the present time.

PENTON is a completely new thermoplastic polymer now in pilot plant production by Hercules Powder Company. It has an interesting combination of mechanical, electrical, and chemical-resistance properties and can be moulded in ordinary injection and extrusion equipment. Chemically, the polymer is derived from well-established and readily available raw materials and is a high molecular weight chlorinated polyether, linear in nature, crystalline in character, and, unlike most halogenated polymers, extremely resistant to thermal degradation at moulding and extrusion temperatures.

It has the following chemical structure:



Although the polymer contains approximately 45.5% of chlorine its heat, light and chemical stability is good as can be seen in the tables that follow. The theoretical reason for this as propounded by Mr. E. W. Cronin when he presented a paper on this material to the American Society of Mechanical Engineers, is that the chloromethyl group is attached to the neopentyl carbon atom and because there is no hydrogen atom in the β position no HCl is formed. Practice in this case appears to support this theory.

Mechanical Properties

The mechanical properties of Penton are shown in the table. Attention is drawn to the heat distortion and water absorption figures also to the dimensional stability. With Penton the dimensional change under adverse circumstances is substantially nil. For example, the greatest dimensional change of a 2 in. disc, tested according to ASTM–D756–46T(1) which involves 25 hours' exposure at 140° F. and 88 per cent. relative humidity followed by 24 hours' dry heat at 140° F. cycled seven times, was about one mil per 2 in. A 2 in. diameter, ¼ in. thick, injection moulded disc when exposed for 195 days in water at 100° F. changed less than one mil in any dimension. The dimensional stability of Penton at elevated temperatures is another interesting phenomenon. An injection moulded gear 3 in. in diameter when measured at a room temperature and again after 20 minutes at 300° F. showed a change of only one mil.

This dimensional stability which is closely linked with the production of strain free mouldings is assumed to be due to the slow rate of crystallization of the amorphous material in the mould. The volume change on cooling being taken up by the amorphous regions until such time as complete crystallization has taken place. By having a mould temperature of 190° to 200° F. the mouldings produced have, in all but a very few exceptional cases, shown no strain patterns.

MECHANICAL PROPERTIES

Moulding temperature ...	440–465° F.
Injection moulding pressure	10,000–20,000 p.s.i.
Specific gravity	1.4
Mould shrinkage	0.004–0.006 in./in.
Tensile strength at 73° F. ...	6,000 p.s.i.
Tensile strength at 212° F. ...	3,500 p.s.i.
Elongation at 73° F.	60–160%
Elongation at 212° F. ...	200–250%
Flexural strength (beam) at 73° F.	5,000 p.s.i.
Water absorption	0.01%
Izod impact (notched) 73° F.	0.4 ft. lb./in. notch
Izod impact (notched) 40° C.	0.2–0.3 ft. lb./in. notch
Rockwell hardness at 73° F.	R100
Deformation under load at 122° F. and 2,000 p.s.i. ...	1.4%
Compressive stress at 1% offset	8,800 p.s.i.
Heat distortion—	
5 x ½ x ½ in. bar—264 p.s.i.	185° F.
5 x ½ x ½ in. bar— 66 p.s.i.	300° F.
Thermal coefficient of linear expansion	8.0×10^{-5}

ELECTRICAL PROPERTIES INJECTION-MOULDED DISCS ¼ IN. THICK

Loss factor—	
50 cycles	0.03
1.2×10^5 cycles ...	0.03
67×10^6 cycles ...	0.06
Diddipation factor—	
50 cycles	0.01
1.2×10^5 cycles ...	0.01
67×10^6 cycles ...	0.02
Dielectric constant—	
50 cycles	3
1.2×10^5 cycles ...	3
67×10^6 cycles ...	3
Volume resistivity ...	1×10^{15} ohm–cm.
Dielectric strength ...	400 v./mil.

Chemical Resistance

Changes observed in moulded strips of Penton after immersion in various chemicals for several lengths of time at different temperatures show that the tensile strength was, in some cases, actually increased by the exposure. This is probably not so significant as the fact that with most exposures there was relatively little change in tensile strength, weight, or appearance.

Weathering

Moulded pieces of stabilized Penton have been exposed to outdoor weathering in Delaware for one year. The exposed specimens retained their original tensile strength and hardness but did lose elongation to a considerable extent. These changes are illustrated by the following data:

	Tensile Strength p.s.i.	Elongation per cent.	Rockwell Hardness R Scale
Original...	6,000	80	97
Six months' exposure...	6,500	12	103
One year's exposure ...	6,100	12	97

Colour

Penton as now made is a straw-coloured semi-translucent material. Because of this colour, bright pastels, particularly in blue shades, are difficult to make. All other colours and whites are possible.

Injection Moulding

Extensive injection-moulding studies have been carried out on the polymer and a number of conclusions pertaining to moulding this material have been established.

1. Cylinder and mould steels of special types are not required with Penton.
2. Gate size may be between so-called pinpoint type and the larger gates, for example, ¼ in. diameter. The pinpoint type is satisfactory for parts with thin sections up to about 0.075 in. Parts with wall sections above this figure should have larger gates.
3. Drying of the powder before moulding, in general, is not necessary.
4. Material temperature from the cylinder may range between 370° F. and 465° F. The temperature selected should be the lowest possible commensurate with thickness of moulded section and gate size.
5. Die temperature is a critical variable in obtaining rapid moulding cycles. Studies have shown that a die temperature of 190–205° F. is necessary for optimum rate of setting in the mould. A higher or lower temperature than this results in a markedly slower cycle.
6. Moulding cycles have been found to be dependent on specimen thickness.
   Wall sections up to 1/16 in. can be moulded in 20 seconds or less.
   Wall sections of ¼ to ½ in. can be moulded in 80 seconds or less.
7. Flow properties of melted Penton are somewhat different from those of other known polymers. Its melt viscosity is quite low, so that thin sections are readily filled during the injection process. However, this melt viscosity is such as not to require screens or the like in the cylinder in order to prevent drooling.

Extrusion

Data for the extrusion of Penton, from both laboratory and field trials, have shown the polymer to be readily handled by the extrusion method of fabrication. Extrusions have been made, without difficulty, varying in shape and dimension from sheet stock of 0.005 to 0.030 in. thickness to rod of 0.010 to ½ in. diameter and to pipe or tubing 1/16 to ¾ in. inside diameter.

The optimum screw design for the extrusion of Penton has not been ascertained; however, no serious problem exists with such designs as those used for the extrusions of nylon, vinyl chloride, and the cellulosics.

Extrusion-barrel and die temperatures may range from 360° F. up to 450° F. The actual temperature selected will depend on the item to be extruded; for example, sheeting 0.005 in. thick requires temperatures of about 430° F., whereas pipe of heavier cross section requires temperatures of only 360° F. to 400° F.

Applications

Details of some applications have been published (*Modern Plastics* 1957/Feb./150) which suggests the use of Penton for various engineering, chemical and electrical components.

New Productions

The Spa-Flo Company water aerator.

Water Aerator

A new product of the Spa-Flo Company, Reading, is an attachment for fitting on to a domestic water tap. The nozzle of this appliance is moulded in polystyrene by Injection Moulders Ltd.

Floral Fountain

Amongst the many attractions at the Ideal Home Exhibition held at Olympia recently was the centre-piece of the Grand Hall. This consisted of a 20-ft. fountain which played in the centre of an 80-ft. spiral of peonies. Around the base were revolving flower beds in many colours. All the flowers and foliage, some 8,000 blooms, were manufactured from Cinemoid acetate sheet by the Miller-Kent organisation and were accurate reproductions of the natural flowers they portrayed. Cinemoid is a specially formulated non-inflammable acetate sheet manufactured by British Celanese Ltd.

Parasol Pack

The new parasol pack for the Bath Bubbles manufactured by Cosmetique Vigdor (Londres) Limited, of London, N.1, is manufactured by E. S. & A. Robinson Ltd. of Bristol. The cellulose acetate film is made by Courtaulds Limited and marketed by British Cellophane Limited, of London, W.1.

The Bath Bubbles, coloured gelatine spheres containing perfumed bath oil, are placed within a conical container of cellulose acetate which is over-printed in gold with a design of lines and stars and with the name of the product.

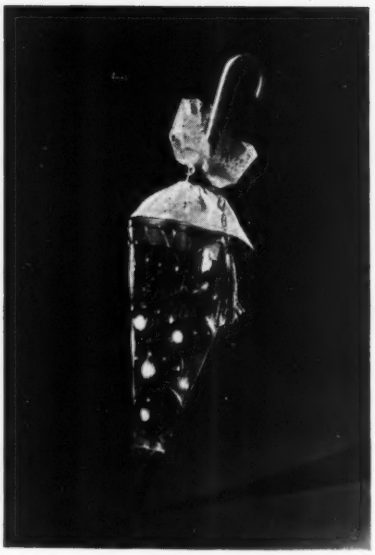
To complete the impression of a miniature parasol, the mouth of the conical container is covered by p.v.c., printed with an overall design in white and gathered in folds. A strip of adhesive cellulose tape in gold secures the p.v.c. to the acetate containers.

Dual Purpose Car Cover

A novel two-in-one car cover/tent made with p.v.c.-coated fabric has just been put on the market.

This cover is so tailored that it can be quickly converted—by means of a separately available framework—into a tent providing sleeping accommodation for four to six adults.

Made with Geon p.v.c., the cover is completely water and rot-proof and extremely resistant to abrasion.



Acetate and p.v.c. parasol pack.

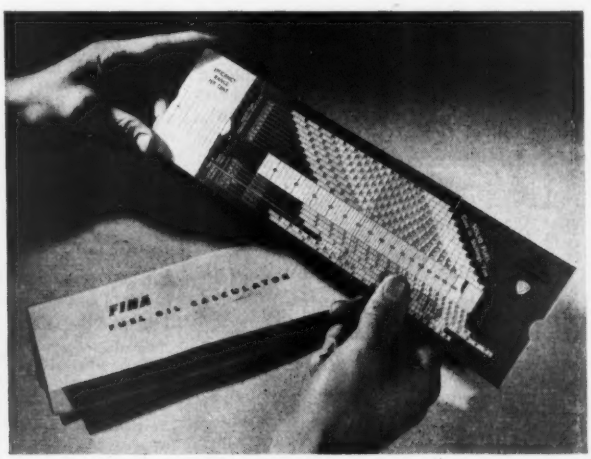
The Car-Cap as it is called, is manufactured by The Cover Co. using Geon p.v.c.-coated rayon made by Bernard Wardle (Everflex) Ltd. It is supplied in three sizes.

Fuel Oil Slide Rule

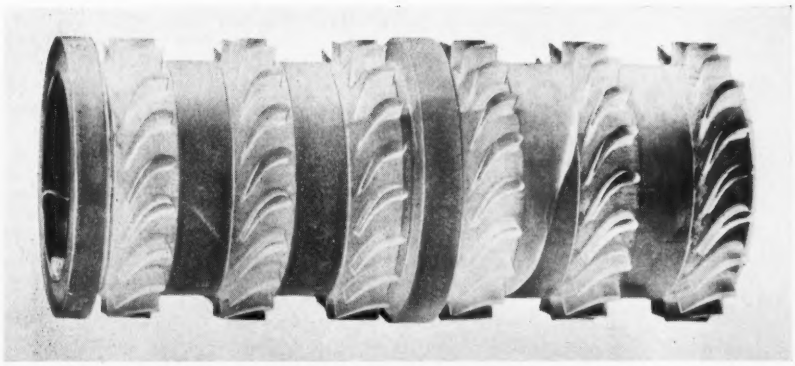
The steady rise in the price of solid fuels and their occasional scarcity has made oil fuel become an attractive alternative to the industrial or commercial undertaking.

One of the first questions asked is the comparative cost of oil and other fuels. To make this calculation easier and quicker, Fina Petroleum Products Ltd. have designed a neat and inexpensive slide rule which will greatly assist, not only their own fuel oil department staff, but also potential customers. Because of its dimensional stability and printability Xylonite (cellulose nitrate), was the material chosen for the production of the slide rule. Xylonite is produced by B.X. Plastics Ltd. The rule is manufactured by U.K. Plastics Ltd.

(Left) The floral fountain at Olympia made from acetate blooms.



Slide rule for fuel oil calculations made from Xylonite.



(Above) A polystyrene pattern used as a temporary pattern material in investment casting an oil well fluid turbine rotor.
(Right) Polythene lubricant dispenser for use in garages to dispense upper cylinder lubricant.

Novel Use of Laminated Timber

The entrance porch to a new building recently completed at the works of Leicester, Lovell & Co., Ltd., North Baddesley, Southampton, provides a further example of the growing use of laminated timber as a building material. Although its use in this particular example is somewhat novel, it nevertheless gives some indication of the value of laminated timber not only for its functional suitability but also for its possibilities in adding grace to the structures in which it is used.

The porch, which was manufactured by Coventry Timber Bending Co., Ltd., using one of Leicester, Lovell's weatherproof Resorcinol resin glues (Cascophen RS.216-M), was delivered to the site as three separate components—the canopy and the two supporting members. The timber used was Iroko, the canopy being made principally from $\frac{3}{4}$ in. laminæ and the supports from 1 in. laminæ. Drainage of rain water from the canopy is effected by means of copper tubing running down through the supports.

Motor Lifeboat

The largest lifeboat yet built from glass reinforced polyester resin recently passed the Ministry of Transport tests and has been certified to carry 144 persons. The lifeboat has been built by W. & J. Tod Ltd. for use initially on the Oriana which is due for delivery in 1960 and has an overall length of 37 ft. 6 in. and beam of 12 ft. 6 in. Besides the hull, the seats and lockers and other fittings are moulded in the same material and form an integral part of the whole structure. Apart from wooden rubbers, bilge rails, bulkhead cappings and gunwale, practically all structural woodwork has been dispensed with. The bilges of the lifeboat are filled with Onazote and enclosed by a laminated flooring providing a sandwich structure of considerable strength.

The materials used were B.I.P. Chemicals resin and for the reinforcement Fibreglass 2 in. chopped strand mat. A final glass to resin mix ratio of under 3:1 was obtained.

Two of the tests undergone by this lifeboat were the Ministry of Transport's 7 ft. 6 in. Drop Test and the 100% overload test. For the latter test it was suspended from the release gear and loaded to an all-up weight of 34 tons. Deflections then recorded were $\frac{7}{16}$ in. sag in the keel, less than $\frac{1}{16}$ in. spread and $\frac{5}{16}$ in. drop in the gunwale. At 25% overload the deflections were too small to be recorded and on unloading all readings returned to zero.

The lifeboat is powered by a Parsons Peregrine air-cooled diesel engine giving a speed of 6 knots when fully loaded.

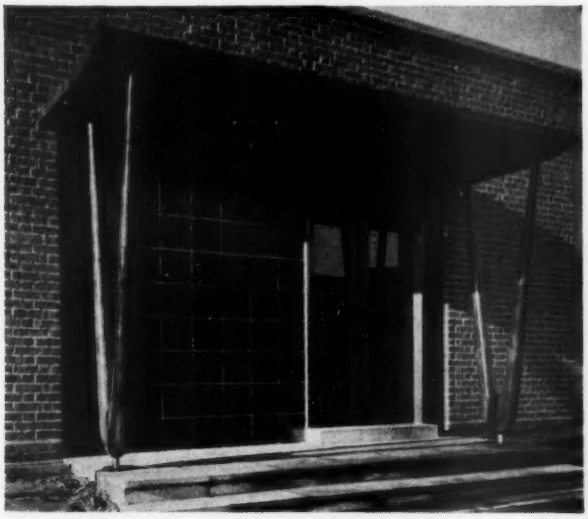
Lubricant Dispenser

A recent product of Fibrenyle Ltd., 157 Dukes Road, London, W.3, is the upper cylinder lubricant dispenser moulded for the Non-Drip Measure Co., of Croydon, Surrey. This bottle which is made of polythene has been specially designed for this particular application, which called for a wide base to give stability to the dispenser. The translucent qualities of polythene have also been used in that the contents of the dispenser can easily be checked.

Printed Circuits in Computer

Mercury, the new large scale electronic digital computer introduced by Ferranti Ltd., has been designed to perform intricate scientific and technical calculations at exceptionally fast speeds. Among many interesting features of the new computer, is the fact that extensive use has been made of printed circuits in its design, including the basic control circuits, accumulator and multiplier components as well as printed wiring for the terminal boards.

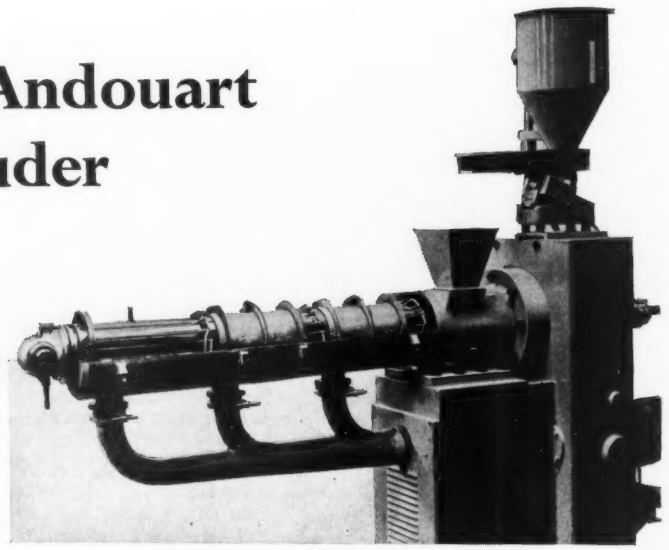
These circuits, which are produced on Bakelite copper-clad laminated materials, of both rigid and flexible grades, make it possible to reduce the bulk of many of the assemblies, thus helping to keep down the overall size of the computer. In addition the use of printed circuitry eliminates the possibility of faulty wiring, and makes servicing and maintenance very much simpler. By adopting this system it has been possible to make the computing parts into interchangeable packages, enabling quick replacement if necessary.



(Left) Laminated timber porch using synthetic adhesives.
(Below) The new Tod glass reinforced polyester lifeboat.

Machines for the Industry

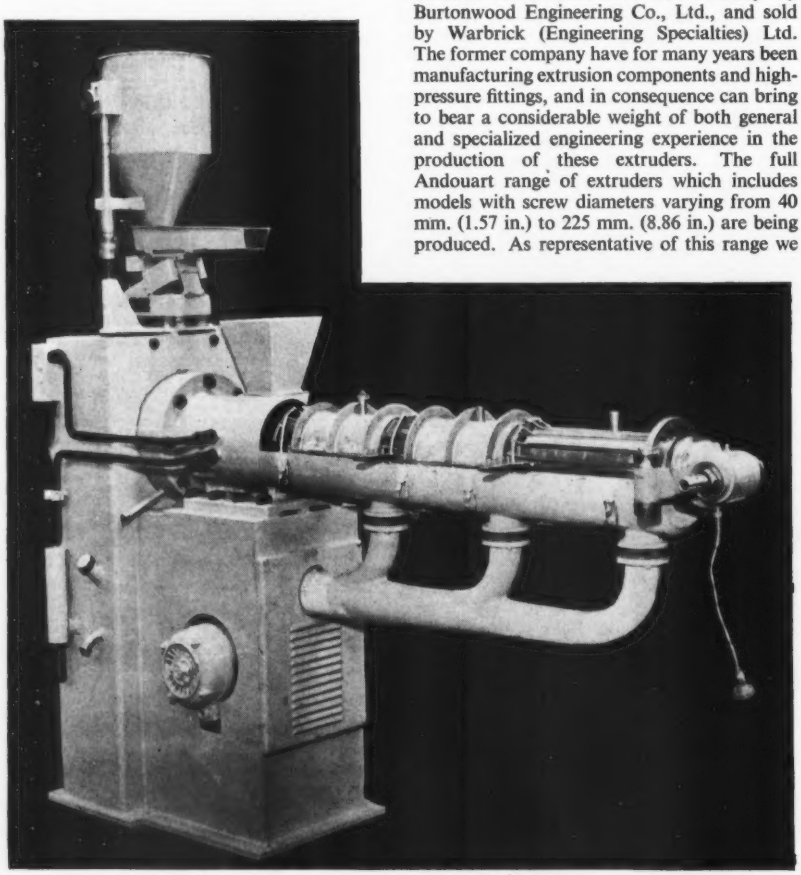
The Burtonwood-Andouart 90 mm. Extruder



The following is a full description of the 90 mm. Andouart extruder originally designed and manufactured in France and now being made in this country by Burtonwood Engineering Co., Ltd. There is also a description of some of the take-up equipment which is available for use with this extruder. The selling agents are Warbrick (Engineering Specialties) Ltd., Sankey Street, Warrington, Lancs.

THE continued expansion in the use of plastics for cable insulation, tubing, etc., with demand for high-speed production in conjunction with high quality products has resulted in the manufacture in this country of extruders of many designs. Some of these designs are British in conception, others American, and some Continental. We have pleasure in describing here an extruder which is of Continental design but of British manufacture.

The Andouart company have for several years been manufacturing in France machinery for the extrusion of rubber and plastics with particular attention to its use for cable covering. For this application a complete range of ancillary equipment is available. Within the last year this popular machine has been manufactured under licence in this country by Burtonwood Engineering Co., Ltd., and sold by Warbrick (Engineering Specialties) Ltd. The former company have for many years been manufacturing extrusion components and high-pressure fittings, and in consequence can bring to bear a considerable weight of both general and specialized engineering experience in the production of these extruders. The full Andouart range of extruders which includes models with screw diameters varying from 40 mm. (1.57 in.) to 225 mm. (8.86 in.) are being produced. As representative of this range we have taken the 90 mm. (3.54 in.) as the subject for this article. This machine has a plasticizing capacity of 200 lb. of p.v.c. per hour.



The 90 mm. extruder with the barrel casing removed and one heating zone uncovered showing the heaters.

Construction

The main body of the extruder is fabricated from heavy steel plate suitably braced to minimize vibration and flexing. Inside it is placed the cooling fan (1) and the reduction gearing, the shafts for the latter being supported on bearing housings bolted to the casing. Also bolted to the main frame is the supporting collar and bearing housing to which the cast steel hopper section (2) is bolted. This section is also supported by the cooling fan housing.

The barrel of the extruder is made from a solid forging of high grade mild steel. It is precision bored and honed internally. On the external surface it is machined to take the heaters, being divided into three zones for this purpose and also drilled for the positioning of the deep-seated thermocouples (3) which are situated in the centre of each zone. The barrel is permanently attached to the hopper section which is cored for water cooling. The complete assembly is fitted with a one-piece hardened and ground nitralloy liner which extends to the back of the feed opening. The liner is honed to a mirror finish. The three barrel heating zones are enclosed in aluminium covers (4). These covers being so shaped as to provide a ducting for the air-blast cooling supplied from the fan through correctly proportioned pipes.

Various types of screws are available for different plastics materials including nylon, p.v.c., polythene, etc. The standard screws supplied have a 15 : 1 length/diameter ratio and have a constant pitch thread with diminishing depth towards the die head. A 20 : 1 length/diameter screw is also available should this be preferred. All screws are manufactured from high tensile nickel chrome steel, case hardened, and machined and ground to the finest tolerances. The screw is also bored for water cooling and tapped at the end to take the flighted tip (5). After machining, the screw is chrome plated and highly polished to a mirror finish. For cleaning and changing it is readily withdrawn from the barrel by removing the inner cooling tube (13) and pushing the screw

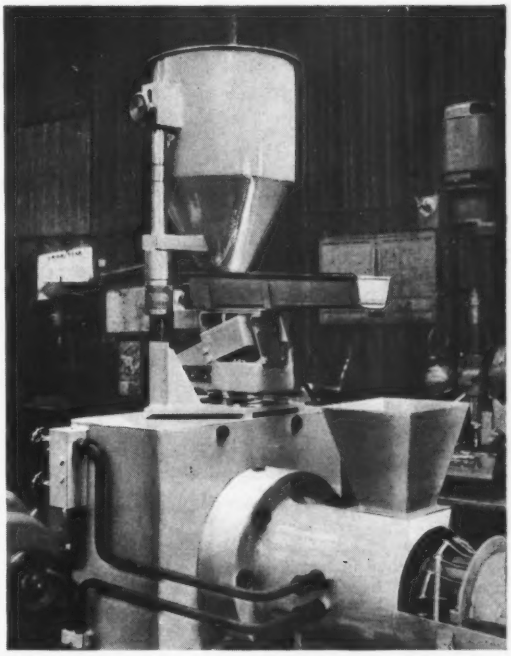
out through the opened head. The screw is keyed to the spurgear shaft.

Reduction Gearing

Power for the extruder is supplied by a 25 h.p. electric motor which drives through vee belts the 19-tooth helical pinion (7). The shaft (8) is supported at each end by bearings held by nuts and locking washers, an efficient oil seal being fitted. The pinion meshes with a 130-tooth helical gear (9) keyed to a shaft rigidly supported at each end by roller bearings. Machined as part of the shaft is a 17-tooth spur pinion (10) which meshes with the 80-tooth spur gear (11). The spurgear shaft which transmits the drive direct to the screw is supported by a steep angle taper roller thrust race (12) which absorbs the thrust transmitted by the screw and which is mounted in a separate housing bolted to the main frame. At the opposite end of the shaft a smaller thrust roller bearing is used. The screw water cooling is fed through the shaft and a special rotating joint at its end enables the cooling tube (13) to be withdrawn without removing the screw, or for the removal of the screw.

Variable Speeds

For the purpose of clarity the extruder shown in our drawing is fitted with a direct reduction drive. Variable speeds are obtained by using a variable speed motor of the h.p. stated previously. If, however, the extruder is to be run from a fixed speed motor a gearbox giving three speeds can be fitted. This is a simple operation involving the replacement of the main drive shaft (8) and the fitting of an extended bearing housing at the vee belt pulley end. The drive is then transmitted from the pulley through the gearbox to the helical pinion. The maximum screw speed with the direct drive is 60 r.p.m., and by using the gear-box speeds of 26·7, 46, and 60 r.p.m. can be obtained. Gear change is by lever situated conveniently on the side of the gear casing.



The hopper unit and vibratory feed chute. The amount of material fed to the chute is controlled by the position of the hopper on its stanchion.

Flood lubrication for all gears and bearings is provided and all shafting is fitted where necessary with efficient oil seals to prevent contamination or leakage. The thrust bearing is lubricated from a separate well.

An inspection cover is fitted to the top of the gear casing affording easy access for inspection to the gear train.

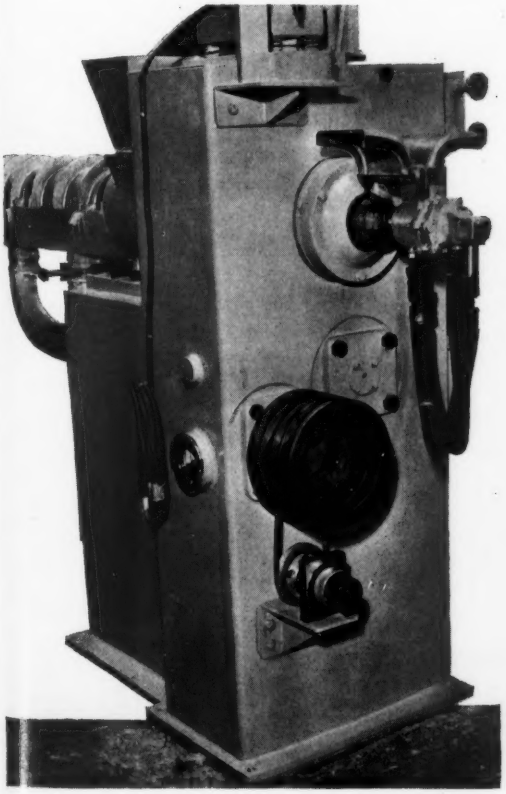
Extrusion Die Head

A strainer or breaker plate is fitted at the end of the screw and beyond this the flighted tip (5). The extruder head is self-centring. The head, itself, is attached to a hinged bracket which enables it to be swung clear of the machine. When running it is held in position by a locking ring (14) with a swing bolt. To facilitate dismantling a special attachment (15) has been fitted to the gear housing and quick and easy access to the different parts is made possible by this. Various types of heads are available, the one illustrated being a side delivery head used for cable covering. Dies are heated by collar resistance heaters. A vacuum attachment may also be fitted when covering cable by the tubing process.

Heating and Cooling

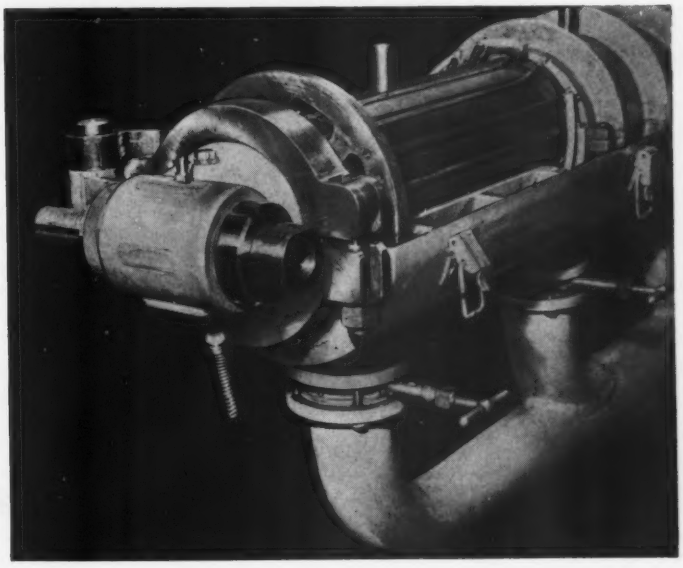
Barrel heating is by hairpin heaters (16) equally spaced around the barrel and recessed into it. The cable for the three heater zones is protected by conduit (17) attached to the side of the barrel.

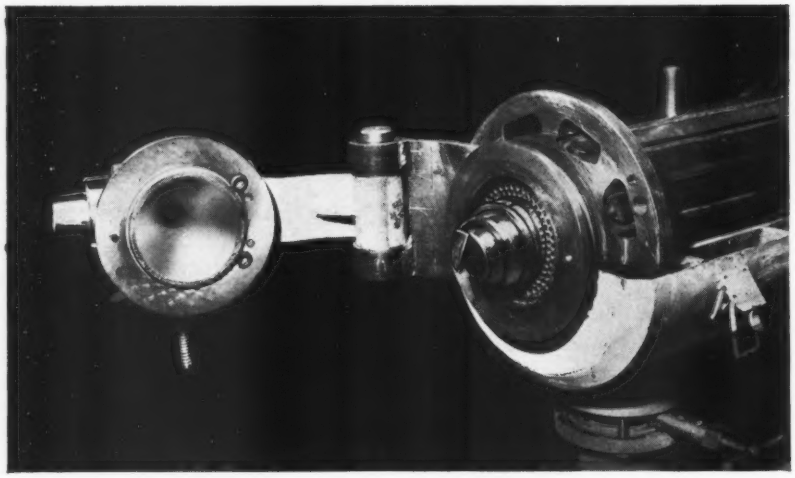
Both water and air are used for cooling. The former, controlled by two valves is used for cooling the extruder screw and the hopper



(Left) The rear of the extruder showing the drive pulley and rotating joint. At the top right can be seen the water cooling control valves.

(Below) The head and die of the extruder showing the locking ring and swing bolt.





A view with the extruder head open showing the flighted tip and strainer plate.

section. Cooling air supplied by a fan is blown around the barrel which, as previously described, is divided into similar zones as for heating. The air supply for each zone is controlled by butterfly valves (18).

Hopper Unit

The main raw material supply is contained in a hopper of 80 lb. capacity. Instead of a direct feed to the screw a vibrating delivery chute (19) transports the granules to the funnel (20) in a regular and continuous quantity. The height of the hopper may be adjusted to control the quantity of material on the chute and a rheostat controls the vibration and hence the rate of feed to the funnel. Infinite variation of feed can be obtained irrespective of the size or type of granule being used.

Controls

All controls except the cooling and speed controls are housed in a separate control panel. Five heating regulators governing the three heating zones of the barrel, the die, and the extruder head are graduated from 0° C. to 300° C. and give proportional control to ±1% of the full scale reading. Each heating control circuit comprises an Iron/Constantan thermocouple with compensating cable, an on/off push-button and indicator light and an instrument pilot relay. Each instrument is fused independently with H.R.C. fuses. On the centre of the control panel is the tachometer scaled from 0–100 r.p.m. for indicating the screw speed. This is signalled from the generator (21) on the extruder itself. Three other push-button switches are for the fan motor, the pilot motor and the main motor, respectively. A 5-pole isolating switch is fitted to the side of the control cabinet and in case of emergency can be operated whilst the machine is on load without any risk of damaging the isolator. The switch is of 60 amp. capacity and is suitable for 230/400 volts 3 phase and neutral supply.

Take-up Equipment

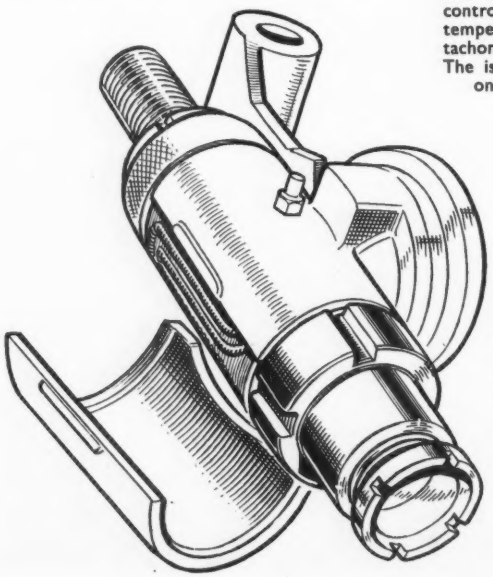
The Burtonwood-Andouart Extruder has an extensive range of ancillary equipment designed to operate efficiently in conjunction with this extruder.

For wire covering the equipment consists of the wire pay-off stand, cooling trough, reversing pulley, capstan unit, tensioning stand and single or dual winder.

The pay-off stand can be either of the single or dual type and is designed to accept drums up to 30 in. diameter. A tensioning device controls the feeding of the wire into the extruder and a band brake is fitted on the pay-off unit to prevent any tendency to overrun. As the wire leaves the extruder it is fed through a stainless steel cooling trough which is 27 ft. long, this trough being fitted with the necessary control and drain valves to regulate the water circulation. The wire reversing pulley has been included in the ancillary equipment for the benefit of users with limited floor space. It has a 24-in. diameter sheave mounted on ball bearings on a tubular frame with a cast base and its function is to direct the wire to the capstan unit which can now be situated alongside the cooling trough or at any other convenient position.

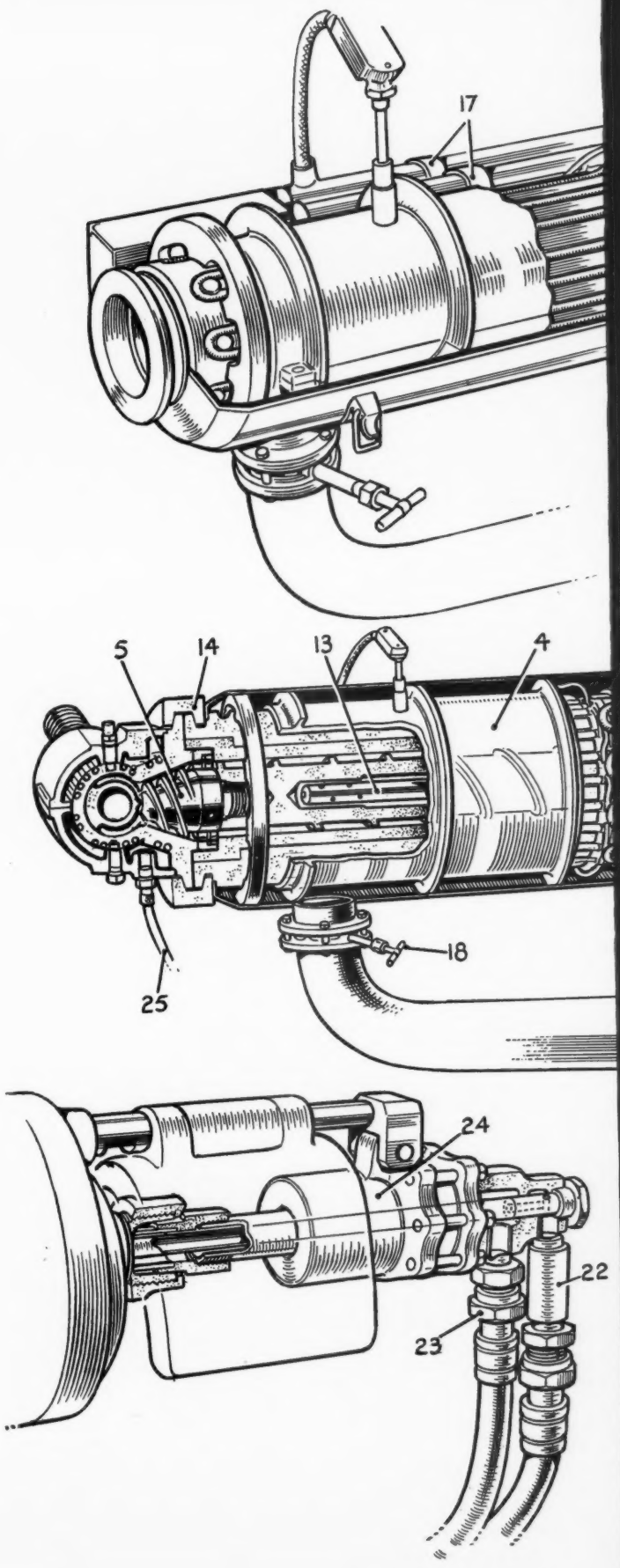
The capstan consists of a three-grooved driving wheel 24 in. diameter with a smaller idler wheel comprising three independent sheaves mounted on the same shaft which is slightly off centre to the driving wheel. This feature ensures a correct wire feed between driver and idler without risk of chafing the insulation.

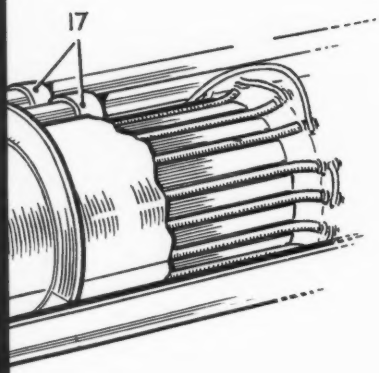
The drive for this unit is by means of P.I.V. gear, Heenan-Froude dynamatic coupling, or variable speed motor depending whether the unit is required to be synchronised with either the extruder drive or winder. The tensioning stand comprises a fixed and a floating sheave



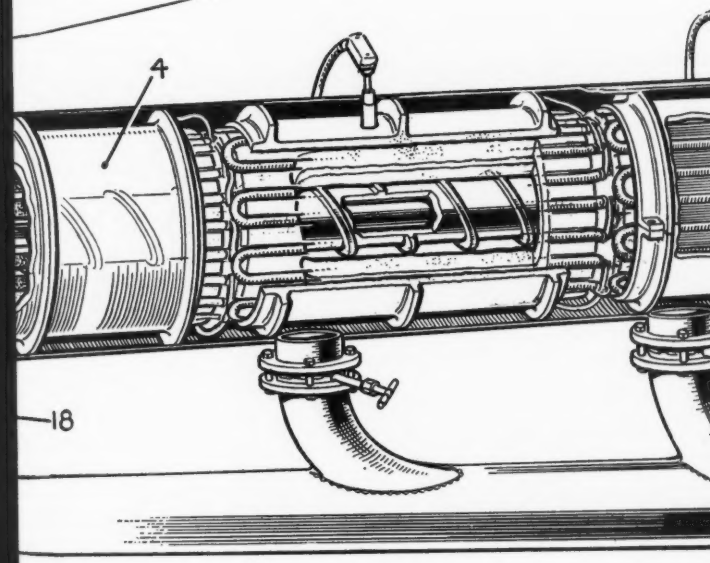
(Left) A sketch of the extruder die with the bottom cover removed showing the heating elements.

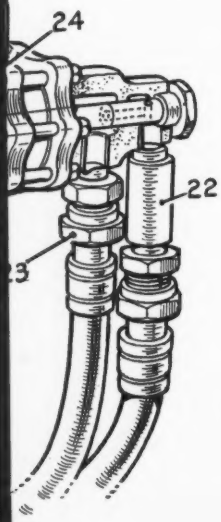
(Right) The control panel showing the three barrel temperature control units and the die and head temperature controls, also the tachometer and instrument fuses. The isolator switch can be seen on the side of the cabinet.


17
5
14
13
4
18
25
24
22
23



1. Cooling Fan.
2. Cast steel hopper section.
3. Thermocouple.
4. Aluminium cover.
5. Flighted tip.
6. Spurgear shaft.
7. Helical pinion.
8. Drive shaft.
9. Helical gear.
10. Spur pinion.
11. Spurgear.
12. Heavy duty thrust bearing.
13. Screw cooling tube.



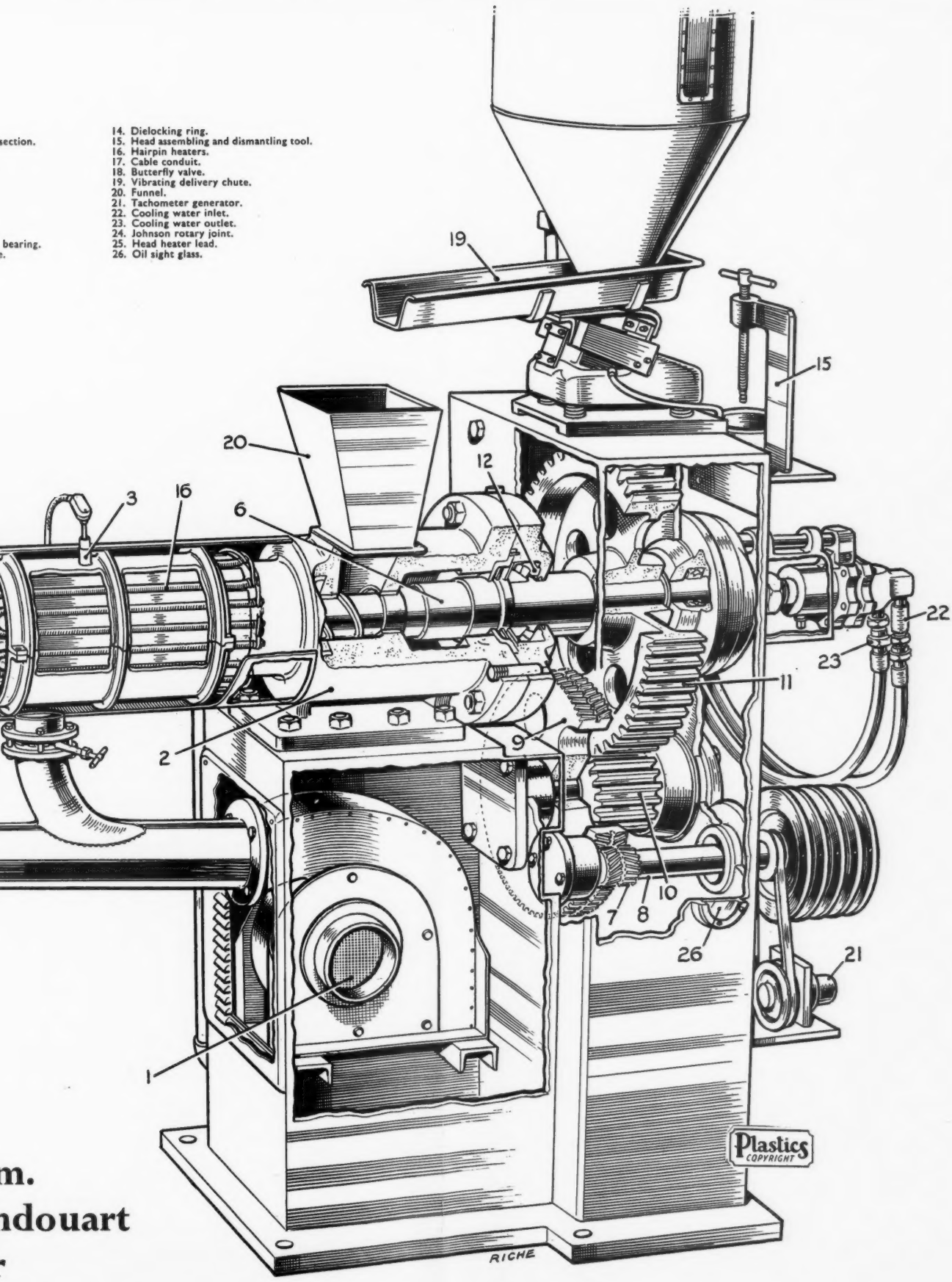


The 90 m.m. Burtonwood-Ando Extruder

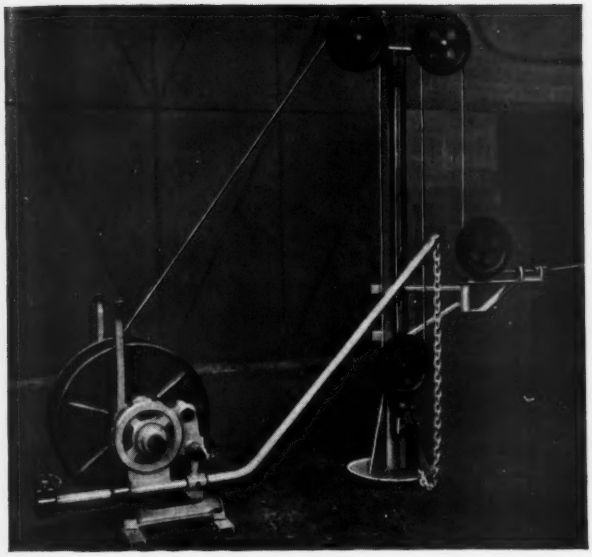
section.

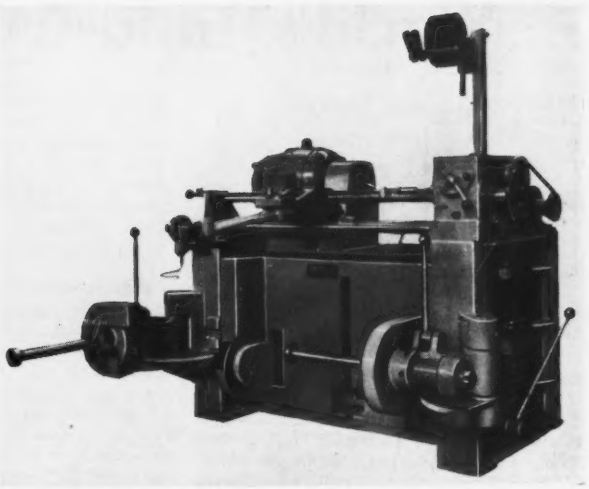
bearing.
e.

14. Dielocking ring.
15. Head assembling and dismantling tool.
16. Hairpin heaters.
17. Cable conduit.
18. Butterfly valve.
19. Vibrating delivery chute.
20. Funnel.
21. Tachometer generator.
22. Cooling water inlet.
23. Cooling water outlet.
24. Johnson rotary joint.
25. Head heater lead.
26. Oil sight glass.



m.
ndouart
r





(Above) The winder unit with one of the drum spindles in the released position.

(Left) A single drum pay-off stand and tensioning unit.

which operates a series of micro switches which, via contactors, control the speed of the motor driving the winder unit.

The winder unit is built to take two drums up to 30 in. diameter and is driven by a 4-h.p. motor via a 3-speed gear box. The speed range by this means is capable of being varied from 0 to 1,200 ft. per minute right through the range. A tension adjustment rheostat is also incorporated in the motor control for use when small diameter cables are being handled. Built into the winder control panel is an ammeter scaled to the full load current of the motor and enables the operator to detect any variation in conditions by its deflection. The winder lay is variable over a wide range to match the winder speed and varying diameters of cable.

Tubing and Profile Equipment

For the extrusion of tubing or profiles an apron conveyor and caterpillar unit can be supplied; the former is an adjustable rubberised canvas conveyor fitted with spray cooling for tubing. The conveyor is driven by a ½-h.p. motor through a 3-speed gear box. The length of the conveyor is 8 ft. although longer ones can be supplied.

Three sizes of caterpillar units are available, the No. 1 normal unit and the No. 1 extended unit, both of which are for cable or tube from ½ in. to 1¾ in. diameter.

The No. 1 normal is driven by a 3-h.p. motor and is capable of a maximum traction effort of 880 lb. The maximum pressure exerted on the belts can be adjustable over a very wide range up to 24,000 p.s.i. and is supplied by articulated rollers operated hydraulically. The setting and tensioning of the belts is by handwheel and the pressure on the belts is by hand control.

The No. 1 extended type is mainly used for tubing and cellular T.V. cable insulation. The larger No. 2 caterpillar is driven by a 5-h.p. motor capable of a maximum traction effort of 3,300 lb. This unit is mainly used for the larger diameter cables up to 4 in. or large diameter tubes. The means of exerting pressure on the belts is similar to that described in the previous paragraph but the length of belt contact is 42 in. in this case compared to 25 in. for the No. 1 normal. The No. 1 extended unit has a belt contact of 50 in.

Acknowledgements

We should like to acknowledge, with thanks, the assistance, advice, and facilities we have received from the directors and staff of Burtonwood Engineering Co. Ltd., and Warbrick (Engineering Specialties) Ltd., in the preparation of this report.

Injection Moulding in Dentistry

A RECENT development in the preparation of dentures and orthodontic appliances was shown at the Exhibition of New Laboratory Techniques. Shown by Prothenyl Ltd., 84a St. Stephens Gardens, Bayswater, London, W.2, this technique involves the manufacture of the mould and injection moulding of the denture.

Mould Making

The mould is made by preparing a plaster model from the original dental mould and the teeth are suitably drilled to allow the injected material to lock them to the plate. The model after waxing is then invested in one half of the mould box in a mixture of equal parts of stone and plaster. The other half of the mould is prepared in a similar way by investing the first half in it having first wiped the parting surface with thin oil. The investing mixture is allowed to set and after boiling to take away the wax the model is removed leaving the teeth in position. A small channel to act as a runner is cut between the sprue hole and the mould cavity; this is then sealed and coated as is the cavity but not the teeth. After hardening the coating, the mould is ready for use and should be pre-heated to 60°–80° C. to obtain best results.

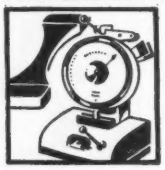
The Moulding Machine

The injection moulding machine is a conventional hand-operated bench machine fitted with a special nozzle incorporating an automatic valve to prevent leakage of the plasticized material. The mould is held in position by a screw clamp and the plunger is operated directly by a rack and pinion action. The heating is controlled by a thermostat and a thermometer is fitted to the cylinder. Moulding temperatures of Prothenyl, the material recommended for use in this application, are 180°–185° C. After moulding the dentures are polished, care being taken to ensure that excess heat is not generated.

Moulding machine, moulds and products.

World's Industry Employs Plastics

MATERIALS and TESTING



Cellulose phenylthiourethane fibres.—Mr. A. L. Allewelt discusses a fibrous product made from the phenylthiourethane of cellulose which has interesting chemical properties, outstanding of which is its resistance to hydrochloric acid. The heat stability is poorer than that of rayon and acetate, but about as good as wool. Its alkaline resistance is poor compared to rayon but better than acetate. Physically, the product has low water-swelling characteristics, low water regain, and a density lower than regenerated cellulose fibres. Mechanical properties are similar to acetate, while dyeing characteristics are similar to wool. The production and properties of the fibre are dealt with.
(*Ind. & Eng. Chem.*, 1957/Jan./71.)

Dipping and moulding with plastisols.—A review of the different methods of using vinyl plastisols includes details of dip coating and also slush moulding. Examples of products manufactured by this technique are shown.
(*Industrie des Plastiques Modernes*, 1957/Feb./1.)

P.v.c. specifications.—In an article entitled "What you should know in specifying vinyls," W. Wayehoff and P. Spink suggest that the designer should only specify the properties and the material supplier or moulder develop the right formulation. The designer, they say, should, however, have a knowledge of what variations in properties can be effected by changing the formulation and with this in mind the authors deal with the principal properties and their variation due to plasticizer content and type.
(*Materials & Methods*, 1957/Jan./116.)

Polymerization mechanism.—Polymer chemists expect most monomers containing two or more double bonds generally to cross link during polymerization. Therefore, most polymers derived from such monomers are only slightly soluble. However, some, notably those from allyl-substituted quaternary ammonium salts containing two allyl groups, are water soluble.
(*Chem. & Eng. News*, 1957/Mar. 11/22.)

Plastics production.—A review of the production capacity of the U.S.S.R., Poland, Czechoslovakia and Rumania is given. Figures quoted include synthetic rubber as well as other plastic materials.
(*Chemische Industrie*, 1957/Jan./53.)

PROCESSES : MACHINERY

Phenolic coating for metal products. — An informative guide by R. B. Young gives details of the properties, use and cost of these coatings. Four types are discussed; these are, the straight phenolics, the substituted or polyhydroxy phenolics, the blocked phenolics, and phenolic oil varnishes. The applications for these coatings include bright brass coating; linings for cans and drums, storage tanks and processing equipment; and primers for products where a high degree of chemical or solvent resistance is required.
(*Materials & Methods*, 1957/Jan./106.)

High speed extrusion.—Practical experience in extrusion with high speed self-regulating spiral fitted type press are presented by E. Beck. The author demonstrates that high output is only possible with a high rate of rotation in the screw feed. He then passes to consideration of the possibility of regulating the process of extrusion not by temperature but in terms of the viscosity of the mass being extruded, using the helical feed itself as the regulating device. After this introduction he goes on to discuss the working of high pressure polyethylene foils, detailing working data for the apparatus. Sections of various thermoplastics such as polyamide, soft p.v.c., polystyrene, polythylene are next considered, including polyamide and polyesters containing one per cent. of carbon black.
(*Der Plastverarbeiter*, 1957/Jan./19.)

Testing weldability.—A new machine manufactured by G. Wiedmann of Fellbach b.Stuttgart surveys in the laboratory to determine whether a hot ceiling lacquered or laminated foil is or is not weldable; determines optimum pressure temperature and time conditions for welding the foil; continually tests laminated aluminium foils and papers to determine continuity of lamination.
(*Der Plastverarbeiter*, 1957/Jan./39.)

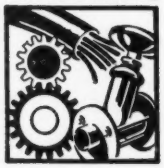
The extrusion of p.v.c. film.—A description of the manufacture of p.v.c. packaging film by the extrusion process has been written by A. Trevisan. Full details are given of the equipment and of the extruder die which was found to be suitable for this type of work. Both vertical and horizontal extrusion techniques have been employed and also a vertical screw extruder has been used. Properties of the film are tabulated.
(*Poliplasti*, 1956/Nov. Dec./18.)

Small automatic injection machine.—Details of a small vertical injection moulding machine designed for the rapid production of small components are given. Its unusual design incorporates a moving mould so that opening of the mould and ejection of the components is done when the mould is removed from the nozzle of the cylinder. The capacity of the machine is 19 cubic cm.
(*Industrie des Plastiques Modernes*, 1957/Feb./42.)

Extrusion dies for pipes.—Some of the factors influencing the design of extrusion dies for pipes are given in an article by R. S. Perkins. A study of these factors has resulted in the presentation of a simple formula relating the land length to the annulus size. The formula is modified for different materials according to their melt viscosity.
(*Australian Plastics and Rubber Journal*, 1956/Dec./23.)

Preforms from glass fibre slurry.—A method of making glass fibre preforms is described. The cellulose binder is first dispersed in water and the chopped fibres mixed with the dispersion. After the preform is made it is dried by hot air and is then ready for resin impregnation. This method of manufacture is claimed to be both economical and extremely fast in comparison with the hand lay-up technique.
(*Chemical Engineering*, 1957/Feb./156.)

INDUSTRIAL APPLICATIONS



Laminated plastics as electrical insulators.—In this paper written by L. Blumental he deals with the five most important properties of a laminate used in this application. Each of the desired properties is analyzed and formula and graphs are given showing the performance of these laminates, tables of properties of sheet, rod, and tubular forms are also included. Most of the work deals with phenolic resin and paper laminates although mention is made of the use of glass as the reinforcing agent.
(*Industrie des Plastiques Modernes*, 1957/Jan./14.)

Fluidized plastic coatings.—An article by Dr. J. A. Newman and Prof. F. J. Bockhoff gives information on the coating of metal parts by dipping them in a fine free-flowing or fluidized plastic powder. Polythene and nylon are the two principal polymers used in this process and the authors give information on their properties and use. Mention is also made of internal coating by conducting the process inside the sealed article.
(*Prod. Eng.*, 1957/Jan./141.)

Glass fibre reinforced pipe.—A report on the production of glass reinforced epoxy pipes in America is given. One company who are now in full production, braid a glass fibre sleeve from filament in such a way as to obtain maximum hoop and longitudinal strength. It is claimed that this type of pipe can be used at temperatures up to 220° F. and 1,000 p.s.i. working pressure.
(*Chem. & Eng. News*, 1957/Feb. 18/122.)

MISCELLANEOUS USES

Sandwich laminates in building.—The author examines several of the available sandwich structures which would be suitable for internal partitioning and gives a list of relevant properties for each. A discussion on the methods of fitting and jointing is also given as well as the economic possibilities of their adoption.
(*Materie Plastiche*, 1957/Feb./92.)

Design for laminated plastics.—A series of illustrations depicting the most desirable design specifications for use with plastic laminates is given. Punching, tapping, drilling and loading are discussed.
(*Prod. Eng.*, 1957/Jan./186.)

Plastics News

Plant and Equipment, Materials, Processes, Company News, Technical Literature, Exhibitions, Personal Notes and Meetings.

PNEUMATIC CONTROL VALVE.—An improved version of the slide valve as used to control compressed air and low pressure hydraulics, forms the basic unit of a range of control valves now being manufactured by Midland Pneumatic Ltd., New Cross, Wolverhampton, Staffs.

Based on the linear slide valve principle, the valve consists of a body housing a simple balanced piston which traverses the valve slide across the lapped ported face. This piston carries low-friction patented seals in a plain bore of honed finish. (When arranged for reversal by pilot air signal the valves are fitted with synthetic rubber buffer rings to absorb the inertia of the moving piston to provide a shockless reversal.)

All working parts are produced from entirely non-corrodible materials of either copper alloy or stainless steel. The basic unit is arranged for 4-way control, of either positive, self-reversing or self-centring action. The latter is available having its ports either blanked or open to exhaust in the neutral position.

COMPUTER FOR CABLE PROBLEMS.—The Addison Electric Co., Ltd., Bosworth Road, London, W.10, have added to their range of quality control and automation equipment for the cable industry, an analog computer designed for application to heat transfer problems in electrical cables. This instrument which is based on the design of J. H. Neher in association with Lymar Engineers Inc.

The new computer allows the determination of the temperature rise at given times and at various locations in and outside the cable upon the application of a prescribed load cycle. Considerable savings can thus be effected by this instrument in the design and the analysis of cable systems.

In use, the thermal constants of the cable and its surroundings are represented by the electrical constants of a resistance—capacitance network. These are set up by means of front panel controls, together with the required load conditions. The latter can be in the form of a complete 24 hour load cycle. The thermal behaviour is then studied at preselected points and times by the aid of a valve voltmeter, whereby one hour of actual time normally corresponds to one second of computing time.

General

High Intensity Infra-Red Projector.—The Metrovick high intensity infra-red projector consists of a standard Metrovick projector with an anodized aluminium reflector in a robust light-weight metal casing and tubular sheathed elements operating at red heat. Instead of straight elements, those in the new projector have crimped ends to provide a greater intensity of heat on the outer edges of the material being heated. These new projectors can be supplied in the same lengths as the standard Metrovick infra-red projectors i.e. 18 in. up to 7 ft. Further details can be obtained from Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester 17.

New High Impact P.V.C.—A newly developed high impact grade of unplasticized p.v.c. compound, Geon RA 170, is now available from British production. This material has been specially designed for the manufacture of rigid p.v.c. pipe for industrial purposes.

Further details concerning the properties of Geon RA 170 and p.v.c. pipe made with this material are given in Information Sheet No. G.101, which can be obtained from British Geon Ltd., Devonshire House, Piccadilly, London, W.1.

High Density Polythene and Nylon Tube.—The General Extrusions Technical Committee of the British Plastics Federation has begun consideration of a specification for high density polythene tube for cold water services. The Committee states, however, that there are certain problems which will take some time to resolve.

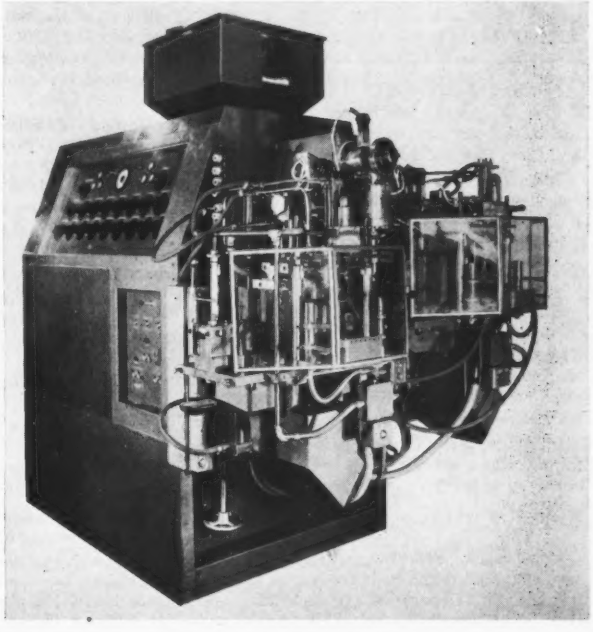
The future possibilities of the use of special grades of nylon tube for hot water services are also being investigated, but at this time its use cannot be recommended.

P.T.F.E. Equipment Wires.—British Insulated Callender's Cables Limited announce the introduction of the new range of equipment wires suitable for use at high temperatures in aircraft and electronic equipment. These wires are insulated with polytetrafluoroethylene and have been developed in close co-operation with the Ministry of Supply.

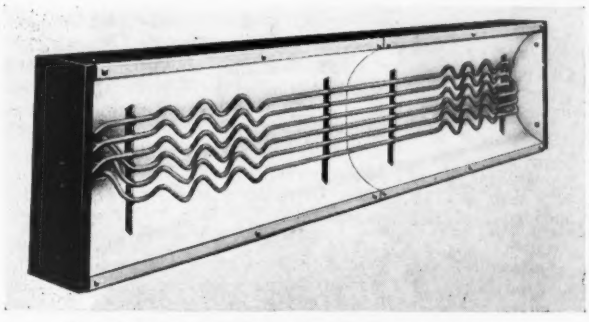
Two ranges of equipment wire are available, designated Types A and B, differing only in their voltage characteristics. These wires have their insulation applied by a recently developed process, resulting in very thin coverings of p.t.f.e., thus giving them a low space factor combined with excellent electrical performance and reliability. Type A is suitable for operation at voltages up to 350 volts r.m.s., while Type B is designed for use at up to 500 volts r.m.s., in both cases when incorporated in the wiring of equipment.

The make-up of both of these cables is similar—annealed, silver-plated copper wire covered with p.t.f.e.—the only difference being that the insulation of Type B is somewhat thicker than that of Type A. A wide variety of colours for both ranges is available, with either solid or stranded conductors.

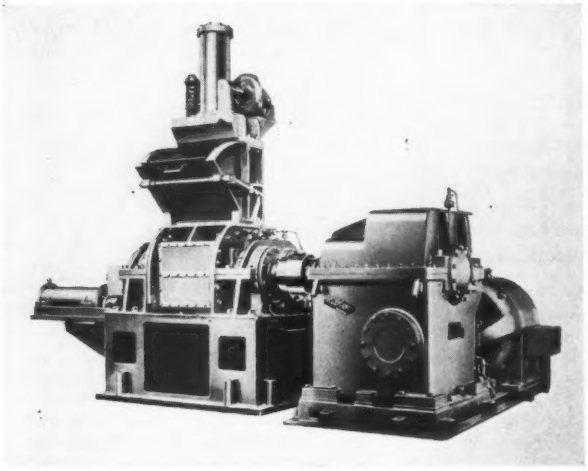
U.K. Manufacture of Bolling Equipment.—Following the introduction of the Davis-Standard range of extruders for Rubber and Plastics Fawcett-Finney Limited of Berkley



(Right) The automatic bottle blowing plant made by E. Shipton & Co., Ltd., and installed at their new Ruislip factory.



(Above) The high intensity infra-red projection made by Metropolitan-Vickers.



The Bolling spiral-flow intensive mixer which with other Bolling equipment is now being made in the U.K. by Fawcett-Finney Ltd.

Street, Birmingham, and Bromborough announce that a licencing arrangement has been concluded with Stewart Bolling & Co. Inc. of Cleveland, Ohio, to manufacture and market their well-known range of Bolling products in Great Britain, the Commonwealth and Europe.

These products comprise: 1. The Bolling Laboratory experimental and production units from 6 in. × 13 in. to 22 in. and 26 in. × 100 in. rolls. 2. The Bolling Calenders of 2, 3 or 4 rolls capacity for Crepe, Plastics, Mastics and Gaskets. 3. The Bolling Vulcanizers from 20 in. to 36 in. standard and 42 in. × 72 in. specials with lengths as required. 4. The Bolling Spiral-flow Intensive Mixer which excells on polythene and on butyl rubber where much higher than normal temperatures are required and temperatures up to 400°F. can be catered for when flood lubrication is employed.

Fawcett-Finney Ltd. welcome enquiries concerning these outstanding machines and will be pleased to supply any further details on application.

Literature

New British Standards.—The following new British Standard Specifications have been issued. Copies can be obtained from British Standards Institute, 2 Park Street, London, W.1.

B.S. 507:1956—Ethanol; B.S. 508:1956—n-Butanol; B.S. 551:1956—n. Butyl acetate; B.S. 553:1956—Ethyl Acetate. These revised standards are the first of a series of revisions on specifications for solvents and allied products.

B.S. 903 Parts D1 and D2:1957—Methods of determination of plastic yield of ebonite. The sections of the two parts deal with the shape and dimensions of the test pieces, the nature of the apparatus, working procedure and method of reporting.

B.S. 903 Parts E1 to E6:1957—Methods of testing cellular ebonite.

B.S. 2835:1957—Containers for sub-standard projector spools.

Unpublished Reports. — Copies of the following reports can be borrowed on application to the Department of Scientific and Industrial Research, Technical Information and Documents Unit, Cunard Building, 15 Regent Street, London, S.W.1.

Development of Cold-Dip Strippable Compounds.—PB.118331. Following experiments reported in PB.118332, further cold-dip formulations based on ethylcellulose, cellulose acetate, butyrate, vinyl resins, and natural and synthetic rubbers, were devised and tested. All were found to be unsuitable, mainly because a sufficiently thick film could not be obtained. The rubbers also had poor stripping qualities, and the vinyl resins were not stable for any length of time.

Room Temperature Dipping Compounds.—PB.118332. Commercially available hot-dip strippable compounds were mixed with various solvents, oils and waxes, plasticizers and resins for possible use by cold dipping. None of these compounds gave useful results.

Direct Resin Filling Materials. Coefficient of Thermal Expansion and Water Sorption of Polymethyl Methacrylate.—PB.116588. The addition of up to 50% filler (alumina, silica, boron phosphate, calcium carbonate, zinc oxide) enhances the value of polymethyl methacrylate as a dental material; and coefficient of thermal expansion and the water sorption are reduced with increasing amounts of filler. Water sorption is affected neither by the pH of the water nor the degree of cross-linking.

Testing of Silicone Rubber at Elevated Temperatures.—PB.121192. The design of a high-temperature test apparatus and its calibration against an unmodified Scott tester is described in detail. Tests of some 15 silicone rubbers, for elongation, tensile strength at room temperature, 212°F, and 400°F are then described.

Friction and Wear Studies of Chlorinated Methylphenyl Silicones.—PB.118216. This interim report describes friction and wear experiments using a Bowden-Leben friction apparatus and a four-ball wear machine on a methylphenyl silicone and three different chlorinated methylphenyl silicones. Data are also presented on comparative wear rates in the presence of several familiar synthetic and petroleum oils.

Plastics in Building and Construction is the title of a booklet showing some of the uses of plastics and synthetic resins in this industry. Copies can be obtained from the Information Department, Distillers Plastics Group, Devonshire House, Piccadilly, London, W.1.

Cellulor P.V.C. and Plasticizers for P.V.C. are the subjects of two booklets issued by British Geon Ltd., Devonshire House, Piccadilly, London, W.1.

Blowing Agents.—The properties of a number of blowing agents suitable for incorporation in p.v.c. polythene, synthetic rubbers, and other compounds and also processing instructions, are given in a booklet prepared by Whiffen & Sons Ltd., Fison House, 95 Wigmore Street, London, W.1. A special information sheet on the use of Genitron N with epoxy resins has also been prepared by the same company.

Hexagon Digest 24 issued by the Dyestuffs Division of I.C.I. contains articles on The Cary Recording Spectrophotometer, The Dyeing of Viscose Rayon at High Temperatures, and, A Small-Scale High-Temperature Dyeing Machine.

Polyvinyl Acetate and Polyvinylpyrrolidone, are the two substances discussed in Technical Bulletins 9 and 14 issued by British Oxygen Chemicals Ltd., Bridgewater House, Cleveland Row, St. James's, London, S.W.1.

High Impact Polystyrene.—A full description of Kleestron Super 44, which is a new grade of high impact polystyrene moulding powder, is given in a leaflet which can be obtained from the manufacturers, Kleestron Ltd., West Halkin House, West Halkin Street, Belgrave Square, London, S.W.1.

Plastics Catalogue. — Prepared by B.X. Plastics Ltd. this catalogue gives details of properties and types of material manufactured by this company. Illustration of some of its applications are included.

Iridon-1000.—A data sheet for a heavy gauge polythene sheet known as Iridon-1000 has been prepared by the manufacturers, Iridon Division, of Commercial Plastics, 1 Avery Row, Grosvenor Street, London, W.1. The sheet is being produced in gauges ranging between .010 in. and .125 in. thick.

Chemical Specification. — Prices (Bromborough) Ltd., Bromborough Pool, New Ferry, Nr. Birkenhead, have issued a specification and characteristics folder on their oleines, stearines, fatty acids and fatty alcohols.

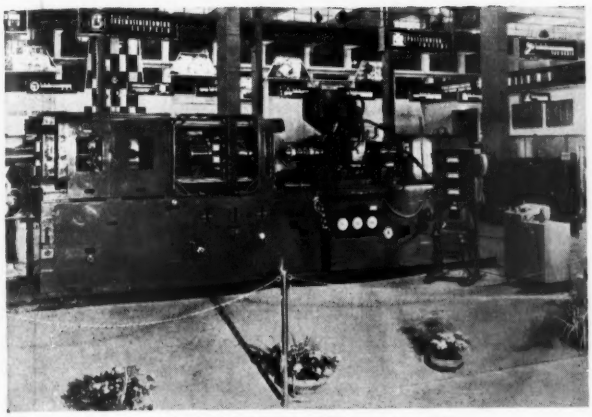
Colouring Materials.—Technical Bulletin 160 issued by Claremont Pigment Dispersion Corporation, 39 Powerhouse Road, Roslyn Heights, Long Island, New York, gives details of colour paste concentrates for use with polyester resins. Technical Bulletin 220 deals with a range of granular colour concentrates for use with polythene.

Nickel Plating.—The Mond Nickel Co., Ltd., Thames House, Millbank, London, S.W.1, have published a small book entitled Nickel Plating for Engineers. This book gives an abbreviated description of the procedure preparation and properties of nickel plating together with some useful tables and references.

Electro-Deposition of Metals.—A 28-page reference book on the electro-chemical depositions of metals has been published by Fescol Ltd., North Road, London, N.7. The book includes a detailed technical section devoted to the properties of nickel and chromium, and tables listing the resistance of both metals to corrosion.

Arc Welding.—A new technical circular dealing with manipulative equipment for manual and automatic arc welding has been issued by Quasi-Arc Ltd., of Bilston, Staffordshire.

Grinding Wheel Dressers.—A leaflet on the Diard grinding wheel dressers has been issued



The R. H. Windsor stand at the Leipzig Fair.

Polythene in the kitchen of the I.C.I. house at the Ideal Home Exhibition.

by Danite Hard Metals Ltd., Danite Works, Carr Hill, Doncaster.

Fans and Filters.—Two books have been published by Sturtevant Engineering Co. Ltd., Southern House, Cannon Street, London, E.C.4. The first one, Fans for Mechanical Draught gives details of various designs of industrial fans. The second book is the third edition of The Precipitron Air Filter. This type of filter was first introduced in 1939.

The Clean Air Act is the title of a book published by the Federation of British Industries, 21 Tothill Street, London, S.W.1, price 2s. 0d. This book explains the main points of the recent Clean Air Act. Another publication by the F.B.I. (price 5s. 0d.) is the *Fuel Economy Review* which is now in its 35th year of issue.

Condensation.—Copies of a paper on condensation by L. Gordon Davies, technical director of Colt Ventilation Ltd., Surbiton, Surrey, are now available from the company.

Strength and Properties of Plywood.—The third part of this bulletin deals with the influence of adhesives and is published by H.M. Stationery Office, price 2s. 6d. (by post 2s. 8d.). The bulletin gives a detailed analysis of the formation of layers of compressed impregnated wood when a phenolic resin adhesive, a urea resin adhesive, and an animal glue are used to bond gaboon veneers of various thickness.

Company News

P. B. Cow & Co. Ltd. announce the gross profits for the year ended December 31, 1956, as £351,614. A final dividend of 5% less tax has been recommended.

Bakelite Ltd. announce the group profits for the year ended December 31, 1956, as £474,921, this compares with a figure of £645,725 for 1955.

Expandable Polystyrene.—B.X. Plastics Ltd. announce that their expandable polystyrene granules previously referred to as Polybex will now be marketed under the name Bextrene X.

Price Reduction. — British Geon Ltd. announce a reduction of 6d. per lb. in the price of Hycars 1041 and 1042. Production of these nitrile rubbers and also of Hycars 1001 and 1002 is anticipated to commence in this country in the third quarter of this year.

New Product for Urethane Foams.—A new polyester for the production of flexible urethane foams has been developed by the Witco Chemical Company, 122 East 42nd Street, New York, and now is being commercially manufactured under rigidly controlled conditions in the company's Chicago plant.

Names Witco Fomrez 50, the new product features a narrow hydroxyl number and viscosity range as well as a uniformly low moisture content.

W. R. Grace & Co., of New York, opened last month an application and research laboratory devoted to studies on high density polythene. W. R. Grace have been licensed by Phillips to manufacture high density polythene.

Camp Bird Ltd. announce that they have acquired a substantial majority interest in the electronic, electrical, and plastics engineering group of Hartley Baird Ltd.

Within the Camp Bird group are Duratube and Wire Ltd. and Tenaplas Ltd. and they also hold a substantial equity in R. H. Windsor Ltd.

J. Day & Co. (Derby Works) Ltd.—The foundation stone for a 25,000 sq. ft. extension to their factory at Harrow Manorway, Abbey Wood, London, S.E.2, was recently laid by the two daughters of the managing director, Mr. Sidney Day.

Rediweld Ltd., of Kelvin Way, Crawley, Sussex, have started a school for the welding of thermoplastic materials. Two complete courses will be run every month and will deal with the welding of polythene and p.v.c. Further details can be obtained from the company.

The Metal Box Co. Ltd. announce that their Head Office address is now 37 Baker Street, London, W.1. Telephone number Hunter 5577.

Carbide and Carbon Enters Fluorocarbons Field.—Plans to build a 50 million pound per year unit to manufacture fluoro-carbons have been announced. The production unit is to be built at the Institute, West Virginia plant of Carbide and Carbon and is expected to be in operation by the latter half of 1958.

Wild-Barfield Electric Furnaces Ltd., of Watford, Herts, are pleased to announce that by virtue of an agreement recently concluded with the National Research Corporation of Massachusetts, U.S.A., they are now manufacturing in their works at Watford, vacuum melting, heat-treatment and analysing equipment of proven National Research Corporation design.

The Projectile & Engineering Co. Ltd. announce the incorporation on January 31, 1957 of an Australian subsidiary—Peco-Hardie (Pty) Ltd.

This new Company has been formed in conjunction with the well-known Australian manufacturers, Hardie Trading Ltd., with the object of manufacturing the already well introduced Peco Injection Moulding Machines, Extruders etc., in the Commonwealth, with operations based in Melbourne.

Hardie Trading has distributed Peco machinery in Australia for some years and the new undertaking will ensure its continuing and increasing availability and service.

Mr. A. L. Beer, who has been associated with the manufacture and sale of Peco machines since their inception, has taken up residence in Australia, and will be Production Manager.

Conferences

Conference on Electronics and Automation.—Britain's leading authorities on Electronics and Automation—each an internationally-known expert in his particular field—will meet at Olympia, London in May. They will be speaking at a Conference to be held in connection with the Instruments, Electronics and Automation Exhibition.

Among the speakers at the main morning sessions will be:—Rt. Hon. Lord Halsbury, Sir Claud Gibb, Sir Walter Puckey, Sir Gordon Radley, Professor J. Rotblat, and Sir Ewart Smith.

The final programme is still to be completed, but a preliminary list of subjects includes the following: " The New Age "; Nuclear Power; Electronic Office; Instrumentation in Medicine; Instruments as a Career; Communications and the Future; Computer Controller Machines; Automatic Gauging; Reactor Instrumentation; Nucleonics and Isotopes in Industry; Electronic Production Control; Electronics in Banking; The Artificial Heart; Isotopes in Medicine; Training the Electronic Technologist; Training for Research; Ship's Radar; Airport Control.

Personal

Mr. J. Cuthbert Robinson has been elected President of the Machine Tool Trades Association for the year 1957–58, in succession to Mr. H. P. Potts.

Sir Laurence Merriam, M.C., J.P., has accepted an invitation to become Chairman of the Furniture Development Council for three years in succession to Sir David Waley, whose term of office ends on May 31, 1957.

His present business activities will not be affected by this appointment.

British Plastics Federation.—The following have been elected chairmen of the various groups of the British Plastics Federation for the session 1957–58:—P. Russell, Plastics Material Manufacturers Group; C. R. Todd, Moulders Group; D. Sullivan, Fabricators Group; J. Trevor-Jones, Engineers Group;

Mr. D. Craven.

J. A. Pentecost, Raw Material Suppliers Group; W. M. C. Norie, Laminated and Fibrous Products Group. Mr. H. A. Collinson is chairman of the Main Technical Committee and Mr. David Radford is chairman of the Publicity Committee.

Mr. S. A. Clodd, Works Manager, Radio and Television, has been appointed an Executive Director of E. K. Cole Ltd.

Consequent upon the appointment of **Mr. Derek Craven** as General Manager of Abrac Australia, the Sales Department of the Industrial Chemicals Division of A. Boake, Roberts & Co., Ltd., has been reorganized. **Mr. Alan Russell** retains the post of Sales Manager of the Division, and **Mr. Barrie White** is appointed to the newly-created position of Deputy Sales Manager. Other changes in management are as follows: **Mr. R. E. Tebbit** has now been appointed Staff Manager and Training Officer. **Mr. C. W. Cornwell** is to retire in June, after 26 years in the Company's service, and will be succeeded as Chief Analyst by **Mr. F. J. Green,** formerly Works Manager of the Stratford factory. **Mr. E. J. Dowsett,** formerly Manager of the Works Study Department, becomes Works Manager of the Stratford factory. **Mr. A. Battersby** is appointed Manager of the Works Study Department.

Mr. W. A. Roffey has been appointed Joint Managing Director of U.K. Plastics Ltd. and of Celluloid Printers Ltd., together with the present Managing Director, Mr. K. P. Allport.

Mr. S. W. Gillies

Mr. J. Kempf has joined the technical staff of Furane Plastics Inc. as Product Development Manager of Adhesives and Coatings.

Mr. H. J. Pick has joined Rubber Improvement Ltd. as a representative for their p.v.c. division in London and Home Counties.

Mr. H. Winning, B.Sc., A.R.I.C., A.M.I.Chem.E., has relinquished his post of general manager, Glass Laminate Division, Tenaplas Ltd., to commence consulting work in the engineering plastics field under the name of Herbert Winning and Associates at 39 Brightwalton, Newbury, Berks.

Minnesota Mining and Manufacturing Co. Ltd. announce the following appointments:—**Mr. H. B. Kosanke** as director of Tape and Electrical Products Division; **Mr. I. R. Danielson** as director of Graphic Arts Division; **Mr. A. C. Ash** as director of Abrasives and Adhesives Division; **Mr. J. A. Thwaits** as director of Engineering and **Mr. J. F. Fowler** as director of Production Staff Services.

Board Changes.—The following changes in the Board of Directors of Griffin & George Limited, are announced:—**Mr. Ronald McKinnon Wood,** O.B.E., has asked to be relieved of his duties as Chairman of the Company, in view of the important public duties he will assume in the near future as Chairman of London County Council. **Mr. K. G. Sinclair** has been appointed Chairman. **Mr. Norman McKinnon Wood** has been appointed Vice-Chairman and relinquishes his appointment as Managing Director. **Mr. Norman Trepte** has been appointed Managing Director.

At the 1957 Annual Luncheon of the British Industrial Measuring and Control Apparatus Manufacturers' Association (BIMCAM), London. Left to right: Mr. F. J. Erroll, M.P., Mr. L. S. Yoxall, Mr. R. G. Kent, and Dr. W. A. Macfarlane.

Mr. S. W. Gillies.—It is announced that Mr. Stanley W. Gillies has been appointed to the Board of Directors of Saro Laminated Wood Products Limited.

Mr. Peter H. Cole, Managing Director of R.H.C. Reclamations Limited, has been appointed to the additional office of Joint Managing Director of R. H. Cole and Co. Ltd.

Mr. H. W. P. Matthey.—Johnson, Matthey & Co., Limited, regret to announce that their Chairman, Mr. H. W. P. Matthey, died on March 6 at the age of 80.

I.C.I. Appointments.—Mr. H. Smith, who has been Joint Managing Director of the Dyestuffs Division of Imperial Chemical Industries Ltd. since 1955, has been appointed Joint Managing Director of the General Chemicals Division. **Dr. C. R. Mavin,** previously Dyestuffs Division Production Director, has succeeded Mr. Smith as Joint Managing Director of that Division. **Mr. R. S. Wright,** previously Production Director of the Pharmaceuticals Division, has been appointed to the Dyestuffs Board as Production Director. **Mr. J. Grange Moore,** who has been a production manager of the Metals Division since 1955, has been appointed Works and Personnel Director of the Wilton Council.

Mr. A. D. Barnsdale, late of Coventry Gauge & Tool Co. Ltd., has been appointed to the position of Sales Manager of Tappex Thread Inserts Limited.

Meetings

April

12th.—"Terylene Fabrics," by Miss M. C. Tubb. The Midlands Section of The Plastics Institute, Birmingham.

15th.—"The Future of Plastics in Power Cables." Informal meeting and discussion opened by Mr. C. C. Barnes, at The Institution of Electrical Engineers, Savoy Place, London, W.C.2. 5.30 p.m.

17th.—"The Plant Engineer and Work Study," by H. A. Gomm. The Kent Branch of the Incorporated Plant Engineers, Kings Head Hotel, High Street, Rochester. 7 p.m.

25th.—"High Softening Polymers Based on Styrene," by Dr. W. G. Barb. The Plastics and Polymer Group of The Society of Chemical Industry, London. 6.30 p.m.

26th.—"Plastics in Aircraft," by Mr. N. Evans. The North-Western Section of The Plastics Institute, Engineers' Club, Albert Square, Manchester, 2. 6.45 p.m.

29th.—Annual Luncheon of The Midland Section of The Plastics Institute, at Queen's Hotel, Birmingham.

May

1st.—"Liquid Petroleum Gases," by C. F. Port. The Southern Branch, The Incorporated Plant Engineers, Polygon Hotel, Southampton. 7.30 p.m.

2nd.—Annual General Meeting followed by paper entitled: "High Speed Thin Wall Moulding." The London Section, The Plastics Institute, The Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1. 6.30 p.m.

7th.—"Contemporary Plant Engineering in the U.S.A.," by H. M. Sylvester. The London Branch of The Incorporated Plant Engineers, Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2. 6.30 for 7 p.m.

Automation Equipment

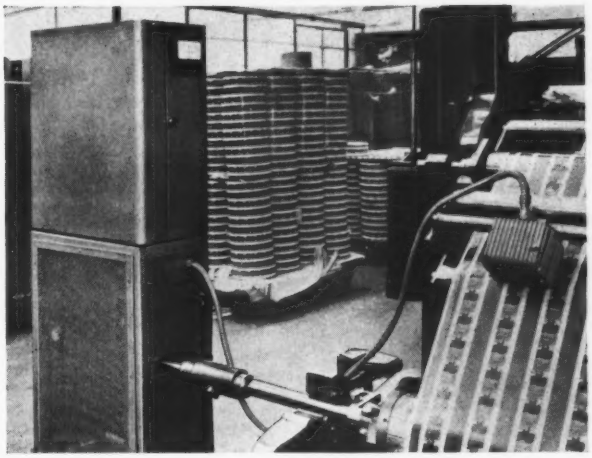
Automatic Web Guiding.—The Trakatron employs a new photo-electric scanning principle to maintain extremely accurate side register of a fast moving web, for slitting machines, re-reeling and similar applications.

The scanning head, mounted close to the web, contains a lamp and a small rotating lens system. These project a spot of light through a window which continuously scans the web laterally across the tracking line (or pattern) over a distance of $\frac{1}{2}$ in. Some light from the spot is reflected off the web on to a photocell. When the light spot passes the edge of the window, the photocell gives a voltage impulse, and when the spot passes the tracking line, the photocell gives a second voltage impulse. If the tracking line moves to the left or right, the time between the two impulses becomes longer or shorter.

Electronic circuits in the control cubicle derive a D.C. voltage proportional to the time between the impulses and hence proportional to the sidelay position. This voltage is used to indicate the web position on a meter, and is also used to control the servo-motor which corrects the position of the web either through a mechanism coupled to the reel stand, or through a tilting roller system over which the web passes.

When the scanning head is tracking an interrupted line, a special circuit produces artificial impulses which maintain the web steady between the end of one line and the beginning of the next.

The Trakatron will control webs running at high speeds exceeding 2,000 ft. per minute. A scientifically designed servo-motor and tachometer feed-back system provides sideways correction up to a speed of 2 in. per second.



The Trakatron web guiding mechanism which uses a new photo-electric scanning principle for its operation.

*J. F. Crosfield Ltd., 2 Elthorne Road, London, N.*19.

Automatic Titration. — The Titromatic Analyser, is connected to the main plant stream and at regular intervals a measured quantity of the solution being manufactured is fed to a reaction vessel. After dilution with water, titration with a standard reagent begins and continues until the solution has been completely neutralized. The amount of reagent used is determined by an "electric eye" which seeks and finds the level of the reagent, and in so doing, records the volume used on a recorder chart. In the meantime, the reaction vessel is emptying itself and the whole process starts again.

The Titromatic Analyser consists of two separate units. One of these is the Chemical Unit, which contains an array of glass vessels controlled by automatically operated taps. The second is the Electronic Control Unit, which determines the precise sequence of operations performed by the Chemical Unit.

The instrument has a wide range of application and the time cycle of a titration can be varied from once every three minutes to once every half hour. It is designed to operate day and night without attention, other than a routine weekly inspection.

The Titromatic Analyser has been developed by Electronic Instruments Ltd., in conjunction with the Billingham Division of I.C.I.

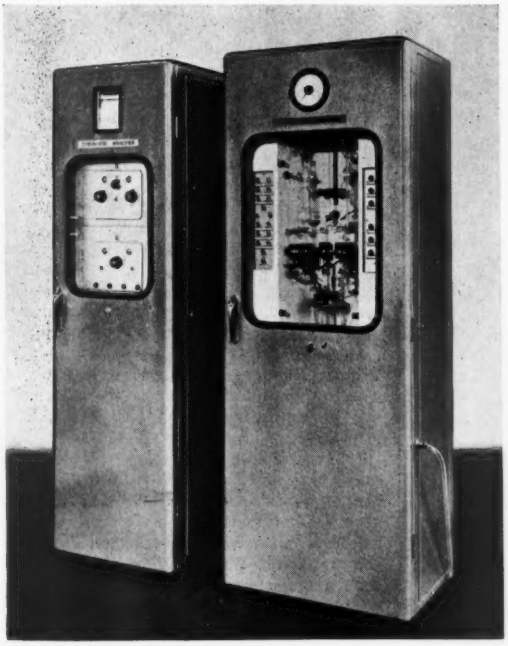
Electronic Instruments Ltd., Lower Mortlake Road, Richmond, Surrey.

Temperature Recorder/Controller.—The new range of self-balancing indicators/recorders controllers has been designed for the measurement of industrial or laboratory temperatures giving potentiometric accuracy reproducible to approximately 0.2% full scale. They can be supplied for any range span greater than 20° C. between −200° C. and + 500° C. as single point recorders and as four point recorders. An additional indicating scale approximately 11 in. diameter can also be fitted to the single point model.

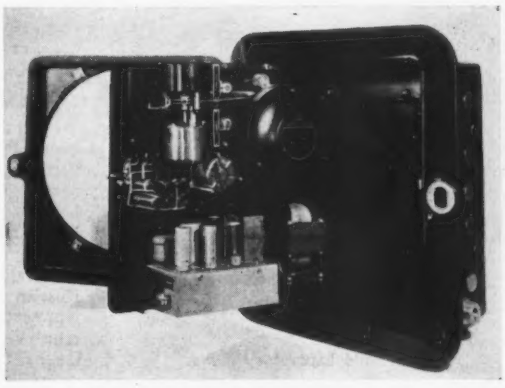
The servo-power available overcomes friction and provides the troque to operate electrical on/off controllers or pneumatic controllers.

The bridge circuit employed is fed with A.C. voltage and there is, therefore, no stabilized D.C. source required, nor is there any need for recalibration or standardization when the instrument is in use.

Fielden Electronics Ltd., Wythenshawe, Manchester, 22.



(Left) The Titromatic automatic titration unit.



(Right) One of the new range temperature recorder/controllers.

TALKING SHOP . . .

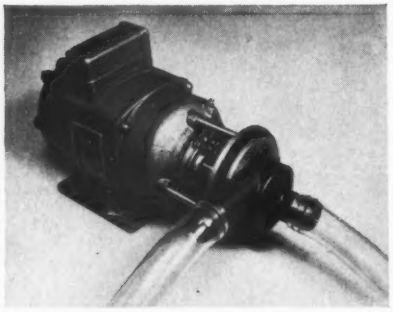
Caution in the City. In view of the growing awareness by the City of the plastics industry, on which I have commented favourably in the past, it is curious to note the antique thought-processes that prompted the City editor of a famous paper the other day to write: "Taking the longer view it is clear that plastics have established themselves . . . the time may be approaching to take an interest in the (plastics) industry." The more curious because in the same note he points out that by 1960 this fledgling industry will be producing half a million tons of raw materials a year. Had he checked the price of raw materials he would have found that an average of 2s. per lb. is not unreasonable. And that is roughly a turnover of £224 million, to say nothing of the capital investment in plant, and the subsequent revenue to the industry by the conversion of that raw material into finished products. How big do we have to become before the magnates really become interested in us ?

* * *

Impasse. An unhappy commentary on the gap that sometimes exists between pure research and industry is the present situation at Birmingham University's Chemistry Department, underlined recently in a lengthy note in the *Financial Times* (March 18). The department has been working on fluorine chemistry, in particular the substitution of hydrogen by fluorine in benzene. Great possibilities are opened up of new plastics having interesting characteristics. But the University has not the staff nor money to make pilot plant quantities, which industry needs for evaluation. Result —standstill, unless an industrial undertaking enters the field and takes over the work. This is one of the ways that our industry suffers from a lack of co-ordinated research and development.

* * *

Rediweld Pump. Dr. H. P. Zade has sent me the photograph, below, of a moulded polythene centrifugal pump. Fitted with a neoprene gasket, and either a stainless steel or monel shaft, as desired, the pump will deliver 5 gallons a minute with a suction head of 3 ft. to 4 ft. and a delivery head of 5 ft. The shaft is integrally moulded with the impellor and directly driven by a $\frac{1}{4}$ h.p. electric motor. Rediweld Ltd., foresee a variety of important applications for this powerful little unit.



Rediweld Laboratory Pump.

U.D.C. The British Standards Institution has just issued a completely revised edition of the abridged schedules for the Universal Decimal Classification. This is the system whereby libraries in industry and commerce can precisely catalogue and file the literature on technical and scientific subjects. It is the most important and most generally used system of classification, and the revised schedules which have now been published, will be of particular importance to the plastics industry, where classification up till now has perforce had to be somewhat haphazard.

* * *

Rum in Karakoram. From Mr. Simpson, of Cascelloid, I have the photograph printed below. Captain M. E. B. Banks, R.M., of the British-American Karakoram Expedition, is imbibing from a Cascelloid polythene container. Can it really be rum ? I thought the days of the fabulous Jeroboam were gone. Anyhow, polythene containers did a fine job

Rum in Karakoram.

on the expedition. Think how much that vessel alone would have weighed if it had been made in china or glass.

* * *

Federation A.G.M. Mr. H. V. Potter was elected President of the British Plastics Federation at the Annual General Meeting on March 20, in succession to Mr. Charles Waghorne. Mr. Cyril Last and Mr. Norman Punfield were re-elected chairman and vice-chairman respectively. Addressing the meeting, Mr. Waghorne said that as a result of a visit to Russian plastics factories last October by representatives of three member firms, a return visit from the U.S.S.R. plastics industry, led by Mr. Nicolaevitch Alexandz Nicolai, head of Russia's plastics industry, would probably take place in April, with the encouragement of the Board of Trade and the British Embassy in Moscow who felt that every step should be taken to encourage Russian trade with the British plastics industry.

Mr. Waghorne referred to the ever-expanding exports of the British plastics industry. When the Federation was formed 22 years ago, he said, the export tonnage of plastics materials was probably not more than 3,000 to 4,000 tons, whereas for 1956 alone it was 98,000 tons, an increase of nearly 13,000 tons on 1955.

He also paid a special tribute to the Engineering Group of the Federation, drawing attention to the great strides that had been made in the last few years in the design and efficiency of British hydraulic presses, injection and extrusion machines which, together with an energetic sales drive, had led to a healthy overseas market for this type of equipment, exports last year exceeding £1 million in value.

Referring to the technical work of the Federation, Mr. Waghorne mentioned that there had been 135 meetings of technical committees and sub-committees in the past year.

* * *

Courses in Birmingham. From Dr. Tolley, head of the chemistry department at Birmingham's College of Technology, I have advance news of a post-graduate diploma course in high polymer technology, to start in September of this year. The subjects of this full-time one year course are: technology of production (40 lectures), fabricating and processing plant (30 lectures), chemistry of high polymers (60 lectures) and polymer properties (30 lectures).

The advent of the advanced course, and the general activity of the teaching centres for plastics, leads me to hope that from being the Cinderella of the industry, education will take its place as one of the most important subjects.

* * *

O.C.C.A. The ninth technical exhibition of the Oil and Colour Chemists Association was held in London on March 12–14. Some 80 companies exhibited, of which a number represented the plastics industry. Although primarily devoted to surface coatings in the pure form, several exhibits were of special interest to the plastics industry, and are reported here.

British Celanese Ltd., demonstrated the fire-retarding properties of trichlorethylphosphate, a colourless liquid having a specific gravity of 1.42. Recommended uses include its incorporation with cellulose acetate, both as a plasticizer and fire-retarding agent, with p.v.c., for the same reasons, and in polyester resin mixes, to increase flexibility and to confer fire-retarding properties. A panel on the stand of British Celanese demonstrated the improvement in fire-retarding properties in plastics materials when quantities of trichloroethyl-phosphate had been incorporated.

Recently announced by British Celanese Ltd. as now forming part of the company's manufacture, vinyl acetate is the starting point for a range of products such as paints, plastics, adhesives, etc., via the polymer, polyvinyl acetate. British Celanese vinyl acetate is now being manufactured for bulk delivery.

PLASTIKON.

Refrigerator door trims moulded in Lustrex by G.E.C.

Lustrex is a Registered Trade Mark

MONSANTO

Regd.

MONSANTO PLASTICS LIMITED,

92 Monsanto House, Victoria Street, London, S.W.1
and at Royal Exchange, Manchester, 2

In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Limited, Montreal. Monsanto Chemicals (Australia) Ltd., Melbourne. Monsanto Chemicals of India Private Ltd., Bombay. Representatives in the world's principal cities.

Amino moulding powders are nowhere obtainable in greater variety of grades or colours than from B.I.P. No less than ten standard grades are available and, additionally, special types evolved to meet particular requirements. The range is ever-increasing, and B.I.P. is always ready to develop and supply "tailor-made" moulding materials wherever a reasonable market offers. Most B.I.P. moulding powders pellet satisfactorily and are made in easy, easy/medium, medium and stiff flow.

B.I.P. Amino and Alkyd moulding powders B·I·P

B.I.P. CHEMICALS LTD., *Oldbury, Birmingham • Telephone: Broadwell 2061*

London Office: *1 Argyll Street, W.1 • Telephone: Gerrard 7971*

Manchester Office: *79 Mosley Street, Manchester, 2 • Telephone: Central 9014*

* **Standard Grades of Moulding Powders**

Beetle X
1st Grade Paper-Filled Urea Moulding Powder. Unlimited colours. Conforms to BS8.1322 Type UX.

Beetle XP
Plasticised Paper-Filled Urea Moulding Powder for Low 'After Shrinkage'. BS8.1322 Type UX.

Beetle XT
2nd Grade Paper-Filled Urea. Whites, Cream, Natural, Opal and Red. BS8.1322 Type U.

Beetle TXC
Special Cellulose-Filled Urea Moulding Powder of High Translucency. For high quality button production.

Beetle BW
Improved Wood-Filled Urea Moulding Powder for good surface finish. Attractive colour range. BS8.1322 Type U.

Scarab
General Purpose Wood-Filled Urea Moulding Powder. Unlimited opaque colours. BS8.1322 Type U.

Plasticised Scarab
Plasticised Wood-Filled Urea Moulding Powder for good dimensional stability. BS8.1322 Type UX

Melmex
Melamine Cellulose-Filled Moulding Powder. Particularly suitable for heavy duty tableware. BS8.1322 Type M.

K.592 and K.595
Mineral-Filled Melamine Moulding Powders for high duty electrical applications.

E.410
Glass-Fibre Filled Melamine Moulding Powder of good mechanical strength and exceptional electrical properties.

Alkyds
Granular and Self Extinguishing types of Alkyd Moulding Powders. Quick curing materials for electrical applications.

"Beetle", "Scarab" and "Melmex" are Regd. Trade Marks

The Properties and Testing of Plastics Materials—Part 9 (Cont.)

Industrial Materials — Special Tests, Properties, etc., Silicones, Phenolics, Ureas, Melamine

By A. E. LEVER,* A.I.R.I., and J. RHYS,† M.Sc.

Section 12. Silicone Resins.

THERE is a short chapter on the chemical analysis of silicones (1) and details of methods of the determination of silicone in waxes, polishes, etc. (2).

Some electrical and physical properties of silicone laminates are compared with phenolic laminates (3).

Properties (2) (4)

It is difficult to give details of various properties of silicone elastomers beyond stating that they are all outstanding in their resistance to heat and cold. The following is therefore an attempt to give some information for those who are interested but direct inquiry should be made to the manufacturers. So much depends on the degree of vulcanization, type and amount of filler, etc.

Grade	*Silastomer* 150	*Silastomer* 180	*E*.310	*E*.360
Density	1.9	1.6	1.18	1.22
Hardness Shore A	45–55	75–85	40	50
Tensile strength, p.s.i.	400	700	600	650
E.B. %	300	75	240	200
Water absorption (7 days), mg/in²	47	7	(%) 12	—
Dielectric const., 10^6 c/s	5.3	4.0	—	—
Dielectric strength, v/mil	500	650	—	—
Brittle point, ° C.		—	— 65	— 84
Vol. resist., ohm/cm, 50 % RH × 10^{15}	—	—	—	1.78

References

1. Chemistry of Silicones—Chapman & Hall, London, 1951.
2. *Trans. P.I.*, Feb., 1949, 24.
3. I.C.I. Ltd., Si.A.5, 1952.
4. Midland Silicones Ltd.

Section 13. Amino, Phenolic, and Allyl Resins.

Amino Resins

A METHOD of testing for cure in amino plastic mouldings is described (1). It makes use of the fact that properly cured mouldings are stained only to a small extent, if at all, after immersion for a short period in a boiling dye solution under prescribed conditions. Details are given of the specific dyestuffs which are suitable. See also melamine (2) (3).

A method for determining the retention of amino resins in the wet strengthening of paper is detailed (4).

Tests for determining the dimensional stability of amino resin mouldings are given (5), with data for various resins.

A procedure for moulding test specimens of aminoplastics is given (6).

Phenol-formaldehyde resins

A British Specification (7) provides the methods of test for phenolic resin mouldings and moulding materials. There are five types:—

Type G .. General.
GX .. Improved General.
MS .. Medium Shock Resistant.
HS .. High Shock Resistant.
HR .. Heat Resistant.

The following methods for determining various properties are given:—

(*a*) Density and bulk factor.

(*b*) Acetone extract. This is considered as a quantitative expression of a property normally associated with degree of cure (8).

(*c*) Tensile strength at break. A moulded dumb-bell test piece is used, and any tensile testing machine is suitable provided the load at fracture may be measured to an accuracy of 1%.

(*d*) Impact strength. An Izod type machine is used with a moulded notched test piece.

(*e*) Water absorption and swelling.

(*f*) Plastic yield.

(*g*) Electric strength, surface resistivity (after water immersion).

(*h*) Resistance to crushing, after heating.

(*i*) Flow. The Cup Flow Test is used.

(*j*) Shrinkage.

No instructions are given for the test piece prior to making the test under consideration.

An American Specification (9) covers twelve types and the tests are very similar to those given in the British Specification except that more attention is paid to conditioning prior to testing (see below).

A useful publication, dealing entirely with phenolic resins (10), contains a chapter on testing, as well as suggestions for chemical tests with details of useful colour reactions, with different indicators. The authors emphasize that these resins absorb moisture comparatively readily, and their physical properties are very greatly influenced by the moisture they contain.

A dimensional Specification for W.C. Seats has been published (11).

A method for the determination of ammonia in phenol-formaldehyde moulded parts and moulding powders is given (12). This is intended to provide information as to whether foodstuffs in the proximity of the moulded material, would become contaminated, or that metal parts might become corroded.

Several methods for the estimation of free formaldehyde are given (13).

It was shown (14) that with rapid qualitative tests, variations in the method of moulding have little influence on residual stresses in a composition of phenolic resin and wood flour.

In thermosetting materials, the shrinkage produced by continuing curing may easily exceed the extension caused by creep (15).

Melamine-formaldehyde Resins

The testing of moulding compounds is given (16), and the following are the various types:—

Type 1. General Purpose (Mechanical and electrical) Alpha cellulose fibre filled.

Properties—Phenol-Formaldehyde

The following details have been extracted from detailed information given in (9) for all the various grades:—

Type	*G.P.*	*High Imp.*	*High Heat*	*High Elect.*
Water absorption max. %	0.80	1.75	0.20	0.10
S.g.	1.45	1.45	2.0	2.0
Tensile strength p.s.i. min.	9,000	6,000	4,500	4,500
Impact strength (Izod) ft. lb./in. min.	0.24–0.34	4.0	0.25–0.65	0.30
Flexural strength p.s.i. min.	9,000	9,000	7–9,000	8,000
Compressive strength p.s.i. × 10^3	22	15	15	15
Mould shrinkage in./in. min.	0.006	0.003	0.001	0.001
max.	0.008	0.006	0.006	0.004
Insulation resistance megohm	100	—	300	300
Dielectric strength (short) v./mil.	260	—	250	325
Dielectric constant × 10^6	—	—	—	0.02–0.009
Power factor × 10^6	—	—	—	0.10–0.045

* F. W. Berk and Co. Ltd. † Consultant.

2. High temperature and electrical. Mineral filler.
3. Improved impact strength. Chopped cotton cloth filler.
4. Medium impact strength. Chopped cotton cloth filler.
5. Unfilled, high translucency.
6. General Purpose. Cellulose filled.
7. Improved insert properties. Alpha cellulose fibre filled.

Detailed requirements are given for compression moulded test pieces, and those for dielectric strength determinations shall be moulded discs or plates $\frac{1}{8}$ in. thick (see below).

(*a*) Immerse the test piece, or article, 5 in. in a circulating oil bath at 300° F.

(*b*) Immediately after removal from the oil bath, immerse in a water bath at 65–75° F., and allow to cool.

(*c*) Remove from bath and wash with detergent, dry and examine for cracks.

The parts should withstand 2 or 3 cycles without failure.

Thermal shock failures occur where there are sharp corners, heavy sections round the handle of a cup, contrasting sections, knit lines and excessive finishing.

A method of identifying melamine in technical products, when present in small quantities, is given (20). This method is based on the preparation of specific crystalline derivatives.

Detailed requirements for compression moulded test pieces (16)

Type No. (see above)	1	2	3	4	5	6	7
S.g.	1.47–1.53	1.76–1.80	1.47–1.53	1.47–1,53	1.46–1.50	1.42–1.48	1.40–1.46
Flexural strength min. p.s.i. × 10^3	12	8	12	11	11	11	8
Impact strength (Izod) ft. lb./in.	0.25	0.30	0.55	1.0	—	0.25	0.30
Water absorption (24 hrs.) max. %	0.4	0.15	0.6	0.5	0.35	0.60	0.60
Mould shrinkage max. in./in.	0.009	0.007	0.004	0.005	0.012	0.008	0.008
Dielectric strength (short) min. v./mil.	300	350	250	130	—	350	350
Power factor max. 10^6 c/s	0.23	0.31	0.24	—	—	0.19	0.28
Arc resistance min. sec.	120	120	125	4	125	70	70

A dye staining technique for detecting any under-curing of melamine plastic mouldings is described (2). This test is of wide application, and intense basic dyes show up well, even on dark mouldings.

The test can be used to determine both optimum cure and under-cured patches due to faulty mould design or moulding technique.

There is an alternative test to overcome the limitations of (3) which is also applicable to urea-formaldehyde mouldings. Melamines are much more resistant to boiling water than some other types, and a 1% aqueous solution of sulphuric acid is frequently used instead.

Acid Boil Test (19)

An aqueous solution of 1% sulphuric acid, by weight, is kept boiling vigorously.

Cut a section from the article to be tested about 3 in. wide, and immerse in the above solution, covering the vessel immediately. Keep solution boiling and remove test piece in 10 minutes. Rinse in cold water, dry and inspect.

A properly cured part should show no sign of loss of gloss.

It is best to use fresh acid solution for each test run, and do not put too many articles in at once otherwise the solution will cool and stop boiling. Also the test pieces should be separated during the boiling so that the solution has free access to all the surfaces.

A comparison is made (18) between dye staining and the staining by tea and coffee.

Thermal Shock Resistant Test (19)

The optimum cure for thermal shock resistance may also be determined by testing in a hot oil bath.

Urea-Formaldehyde Resins

Urea-formaldehyde powders give mouldings in translucent and opaque light fast colours. The mouldings are odourless, tasteless and resistant to cracking by low voltage, low frequency arcs. The material has low after shrinkage and good dimensional stability.

An American Specification (23) deals with moulding compounds of two grades:—

Grade 1. G.P. plus alpha-cellulose filled.
2. G.P. plus cellulose filler, other than alpha-cellulose.

Compression moulded test pieces are used.

Aminoplastic moulding materials (urea or thio-urea and/or cyanamide polymers with formaldehyde) are covered in a British Specification (3). Data for the limits of various properties are given. Two interesting definitions are noted:—

1. **Breathing,** the release of pressure to allow the escape of any gases or vapours from the moulding material.
2. **Dwelling,** the application of part of the moulding pressure for a specified time. This may, or may not, be followed by breathing before applying the final pressure under which the moulding is cured.

A separate Specification for picnic tableware has been issued (17) which is designed to eliminate fragile, etc., articles, but not necessarily to ensure freedom from staining by tea, coffee, etc.

Properties (25)—**Urea-Formaldehyde**
Moulding powder and moulded articles

	Paper filled	*Wood filled*
S.g.	1.48–1.53	1.48–1.53
Hardness—pyramid	45–55	42–55
Tensile strength p.s.i.	7–10,000	7–10,000
Impact strength ft. lb./in.	0.15–0.24	0.16–0.23
Water absorption (7 days) %	2.4–4.2	2.3–4.2
Crushing strength—ultimate p.s.i.	28–35,000	29–36,000
Young's modolus, in bend p.s.i. × 10^5	9.5–10.5	9.0–10.0
Volume resistivity 20° C. 75% R.H. × 10^4 megohm/cm.	50–100	50–100
Surface resistivity 20° C. 75% R.H. × 10^4 megohm/cm.	150–1,400	250–1,400
Dielectric strength v./mil.	200–250	200–250
Power factor 20° C. 800 c.p.s.	0.04–0.08	0.05–0.10
Compression moulding temperature °C.	120–150	120–150
Bulk factor	1.7–2.7	1.9–2.5
Mould shrinkage in./in.	0.007–0.010	0.006–0.010

The following figures are of interest:—

Wet Strength of paper using melamine resins (*p.s.i.*)

	Untreated		3% *resin*	
	Dry	*Wet*	*Dry*	*Wet*
Paper from rags	100	4	130	60
Paper from sulphate cellulose	100	3	122	37
Kraft paper	100	8	116	25

Commercial Standard No. 173–50 for heavy duty alpha-cellulose filled melamine tableware is given (21). Methods of test are included.

Special tests for the presence of poisonous substances, e.g. arsenic, lead, mercury, are given. A boiling water test is included.

A method for determining the degree of cure (3) is to cut the moulding through the thickest section and immerse in boiling water for 10 minutes. The moulding shall be deemed to be properly cured if the surface is not adversely affected in appearance and cannot be scratched with a finger nail. No pronounced odour shall be noticeable after removal from the boiling water (17).

A method for identifying small quantities of urea in technical products consists in the preparation of urea dixanthate (20).

The causes and prevention of crazing in these resins is discussed (24).

Properties (22)—**Melamine Formaldehyde**
Mineral filled moulding powders and mouldings

	Asbestos filled	*Glass-fibre filled*
Bulk factor	2.5–1	2.5–1
S.g. (moulding)	1.80	1.95
Tensile strength p.s.i.	4–6,000	8–12,000
Impact strength $\frac{1}{2}$ in. notch-ft. lb.	0.12–0.22	0.20–0.35
Mould shrinkage in./in.	0.005–7	0.003–5
After shrinkage (48 hours at 100° C.) in./in.	0.002–3	<0.0015
Water absorption (7 days) (3) mg.	30–50	<50
Dielectric strength (short) 90° C. v./mil.	150–250	>200

Allyl Resins

The American Specification (27) covers the requirements for cast sheets, rods and tubes, produced by casting or machining cast blanks. The tests include, in addition to the usual ones, displacement factor, acetone absorption, heat distortion.

(*Please turn to Page 148*)

The Effect of Carbon Black on the Stability of Polyethylene

By JOHN T. MOYNIHAN

This article first appeared in the February issue of the Journal of the Society of Plastics Engineers, U.S.A., and is published here by agreement. The author is a member of the staff of Acheson Dispersed Pigments Co.

CARBON BLACK has been found to be the most effective stabilizer for polyethylene plastic against degradation due to light and weathering (1, 2). This stability is very important when the material is subjected to exposure to sunlight and weathering over long periods of time, such as in electrical cable sheathing applications (3) and in plastic pipe. A study of the interrelation between the plastic and the carbon black surface is important so that future increases in stability may result. For example, the distribution of the carbon black surface within the polyethylene mass is an important consideration for stability.

One obvious characteristic of carbon black as a light stabilizer in polyethylene is that it absorbs light throughout the entire range of the spectrum and so protects the interior of the plastic from the penetration of high energy photons. The solar spectrum at the surface of the earth does not extend with appreciable intensity below a wavelength of 280 millimicrons. Above 300 millimicrons, the intensity increases rapidly with increasing wavelength (4). In considering the photochemical degradation of polyethylene, we must look for structures which absorb energy at wavelengths greater than 300 millimicrons.

Table 1 compares the energy per mole of photons (one einstein) at various wavelengths with the bond energies present in unfilled polyethylene plastic (5).

TABLE I

ENERGY OF LIGHT AT DIFFERENT WAVELENGTHS COMPARED TO CHEMICAL BOND STRENGTH

Wavelength	Energy	Bond	Energy
300 μ	95.3 Kcal/einstein	C-C	62.77 Kcal
400 μ	71.5 Kcal/einstein	C-H	85.56 Kcal
500 μ	57.2 Kcal/einstein		

It is apparent that the energies present at greatest intensity on the surface of the earth are those likely to cause breakage of the carbon-carbon bonds and degradation of the polymer.

Wavelengths much in excess of 400 millimicrons do not have sufficient energy to cause damage to the polymer. In the presence of oxygen, carbon-oxygen bonds may form in a chain terminating reaction before the polymer segments have a chance to reform or cross-link. This serves to explain the presence of aldehydes, ketones and acids in the degradation products of polyethylene degraded in the presence of oxygen (6). On the other hand, hydro-carbons result when the polymer is degraded in the absence of oxygen (7). The preponderance of chain terminating steps in the reaction in the presence of oxygen helps explain the accelerated deterioration of polyethylene during weathering, that is, in the presence of atmospheric oxygen.

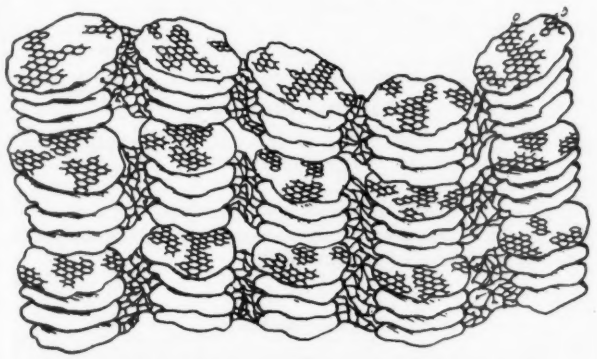


Fig. 1. The structure of a soft carbon black.

In the process of degradation, energy may break carbon-carbon bonds or carbon-hydrogen bonds with the formation of polymer free radicals, activated or reactive polymer molecules, methyl radicals, and other radicals (8). Szwarc (9), among others, has recently pointed out how the carbon surface may take up free radicals before they can react with additional polymer and degrade it. Let us now examine the carbon black surface in more detail. Figure 1 (10) shows a schematic diagram of a typical soft carbon surface which is composed of condensed aromatic rings in the stacked planes characteristic of a graphite structure. In between the graphite areas are hard carbon regions which are disordered arrangements of carbon atoms. Figure 2 shows how the sigma and pi electrons are located at the edges of the condensed aromatic structure and also the pi electron within the condensed structure.

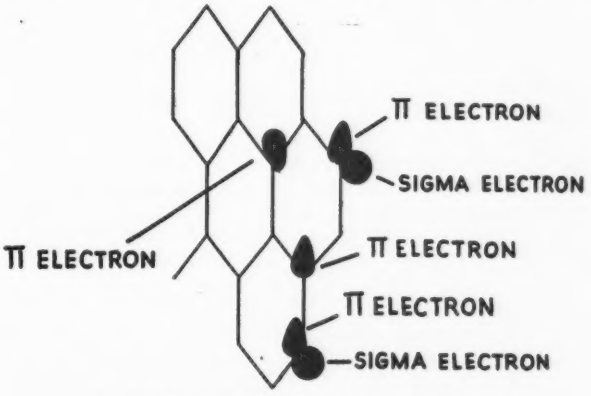


Fig. 2. Schematic drawing of electron distribution for carbon surface.

In actual fact, the carbon black surface is not entirely pi and sigma electrons as shown, but many of the edge positions are saturated with hydroxyl, carboxyl, phenolic, aldehyde and quinone type oxygen-containing groups and also hydrogen (11), which serve to take up some of these electrons. The amount of oxygen occupying the surface at the edges will vary with the conditions of carbon black manufacture.

The carbon black in the polyethylene will stabilize by two mechanisms, light absorption and free radical reaction first at active edge positions of the graphite planes and also in a secondary reaction with pi electrons within the condensed aromatic structure. Certainly the ability of the carbon black surface to absorb light and to accept free radicals will be a function of the amount of surface which is exposed to the plastic, that is, a function of the degree of dispersion. If the amount of dispersion of the carbon black is improved then it follows that the stability of the plastic will improve.

Results

Schaeffer, et al. (12), have shown how the chemisorbed oxygen can be removed from the carbon black surface by heat treatment to 1000°C in a vacuum.

A channel black with an average particle size of 17 millimicrons was subjected to heat treatment while being evacuated so that the oxygen content of the surface would vary. The material was then immediately dispersed at 2% concentration in polyethylene. This polyethylene had a melt index of 0.3 and a density of 0.92. The temperature was controlled at 235° ± 5°F.

The method for measuring the degree of dispersion attained was by the use of an optical density comparison scale of 0 to 30, the zero representing the finest possible degree of colloidal dispersion as viewed microscopically at 100 power magnification. The 30 represents essentially no dispersion. The correlation

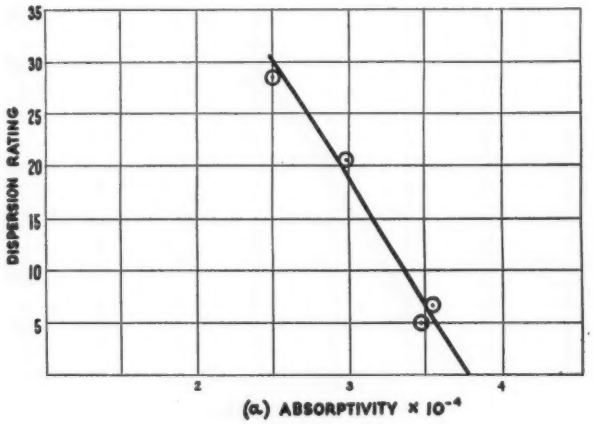


Fig. 3. Correlation of dispersion rating scale with absorptivity.

with the proposed ASTM D20-Subcommittee VII optical density method, is shown in Figure 3. Here a visual daylight filter was employed with a mercury vapour lamp in a microphotometer. The absorptivity, a, is defined as follows:

$a = A/bc$
A = absorbance = $\log 1/T$ = optical density
T = transmittance
b = thickness of the specimen (cm.)
c = concentration of carbon black (grams/cc.)
$\log = \log_{10}$

The more arbitrary optical scale comparison method was used because all the samples were dispersed at the same concentration, shear and temperature, so that a microscopic evaluation in an approximately linear manner afforded greater speed. Nevertheless, the ASTM method is more reproducible especially when smaller differences in dispersion are encountered than those which were obtained in making large surface changes in carbon black in this study.

Constant shear was employed because of the effect of this variable, shown in Figure 4. All of the above conditions were controlled to make certain that the dispersion obtained would be a function of the carbon surface itself.

The effect of varying the surface oxygen content on the degree of dispersion is shown in Figures 5 and 6. Treatments with hydrogen, ethylene and other materials are shown in Figure 7. The change in surface area following evacuation was relatively small as shown by iodine absorption values on the pigment. It is to be expected that with increasing surface area of the pigment the degree of dispersion obtained under the same conditions will be less. This is because of the greater energy required to cover this increased surface. However, if two pigments are compared as in Figure 8, which vary greatly in surface area, the

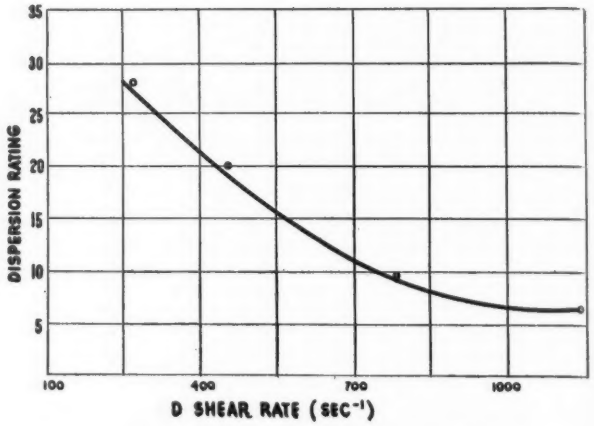


Fig. 4. Variation in degree of dispersion with changing rate of shear.

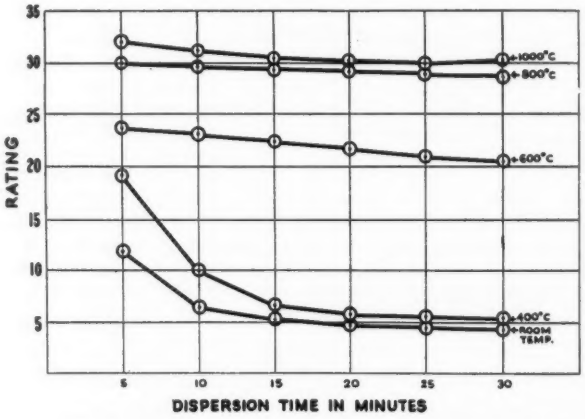


Fig. 5. Change in degree of dispersion with heat treatment.

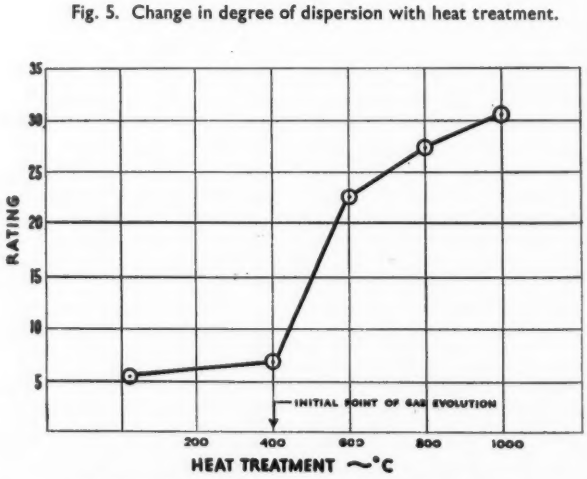


Fig. 6. Variation in degree of dispersion with changing surface oxygen content.

presence of surface oxygen seems to overcome the factor of increased surface area in comparison to a pigment where the surface is primarily hydrogen groups.

Discussion

Figure 9 is a schematic drawing of what seems to occur in plastic dispersion. From a consideration of the above data,

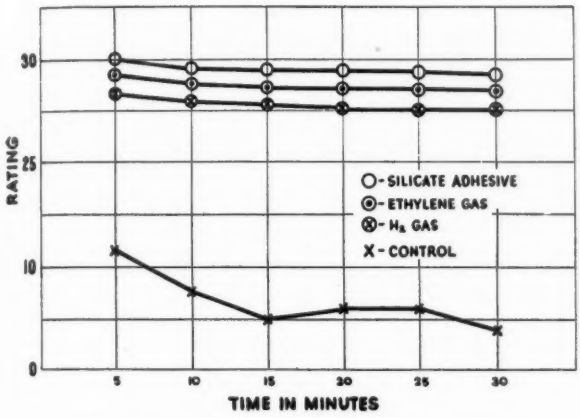


Fig. 7. Effect of carbon surface treatments on degree of dispersion.

it appears likely that at constant temperature, rate of shear, surface area as calculated from electron-microscope measurement, and time of dispersion, the effect of the carbon black surface on the degree of dispersion as measured by optical density may be described by the following semiempirical relation:

(1) $d = k\,(E_{cp}/E_{cc}) + b$

where

d = the degree of dispersion as measured by optical density
k = the fraction of oxygen on the carbon surface
E_{cp} = the bond energy of the carbon-polymer bonds
E_{cc} = the bond energy of the carbon-carbon bonds

The carbon-carbon bond is undoubtedly a van der Waals bond of the hydrogen bond type, the energies of which decrease in the following order between hydrogen and another atom which may be fluorine, oxygen, nitrogen, chlorine, or sulphur (13). The bond between a CH containing surface and another CH containing surface is so weak as to be negligible. Therefore, since the bonds formed between carbon particles are between carbon oxygen groups which have a bond energy of 8 kilocalories and the bond between the carbon surface and the polymer may be a chemical bond, C-O-R (polymer), of 75 kilocalories, a plot of these energies in the above equation versus the degree of dispersion assuming an equal chance for carbon-polymer bonds and carbon-carbon bonds to form, is shown in Figure 10. The bond energies, E_{cp} and E_{cc}, would each be modified by a factor n, equal to the number of bonds, if the distribution of bonds could be evaluated. Since the number of carbon-polymer bonds

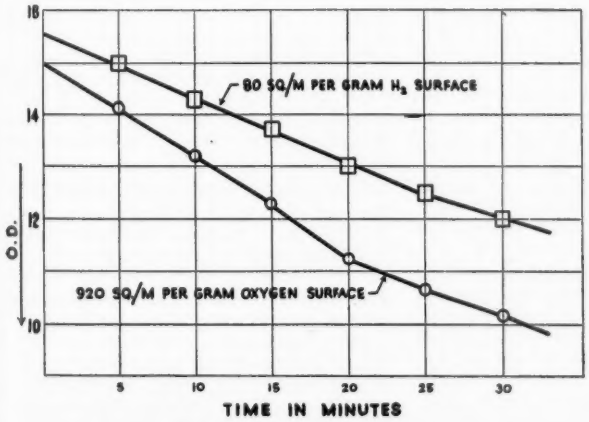


Fig. 8. Comparison of dispersions for carbon blacks of different surface areas and surface oxygen contents.

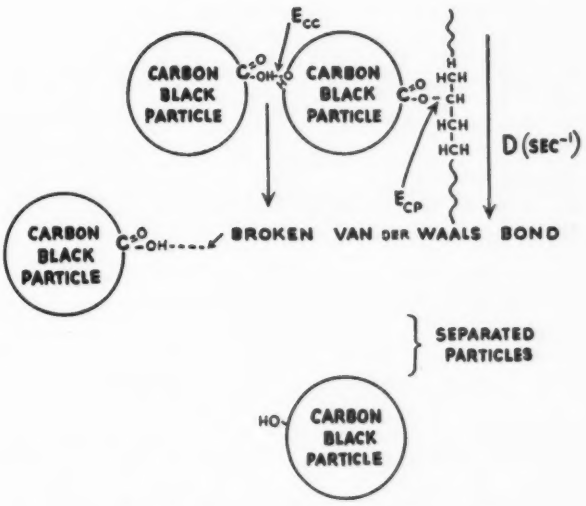


Fig. 9. Schematic drawing of two carbon particles undergoing plastic dispersion.

has not been determined, the exact relationship is still not known. However, the calculation appears related to the observed degrees of dispersion.

Another possible chemical bond is that between a polymer scission fragment broken off during dispersion at high shear which combines with the electrons of the carbon surface in a carbon-polymer bond.

Although the representation or model presented by the above equation may help explain some of the observations by the mechanism of a carbon to polymer chemical bond, an explanation on the basis of van der Waals forces alone is possible. The carbon particles are small spheres. In the aggregated condition the points of contact between spheres is confined to a small area as shown in Figure 11. Since the van der Waals attraction decreases by a factor of $1/r^7$ as the distance, r, between the surface atoms increases, it is readily seen that the number of the van der Waals bonds between the carbon particles will be small in comparison to the number of bonds between the carbon and the polymer. The more deformable, mobile polymer should establish a greater number of bonds with which to overcome the carbon-carbon attraction. Assuming that the van der Waals attraction is negligible after a distance along the radius of curvature of the particle equal to 30 angstrom units, a ratio of the area available

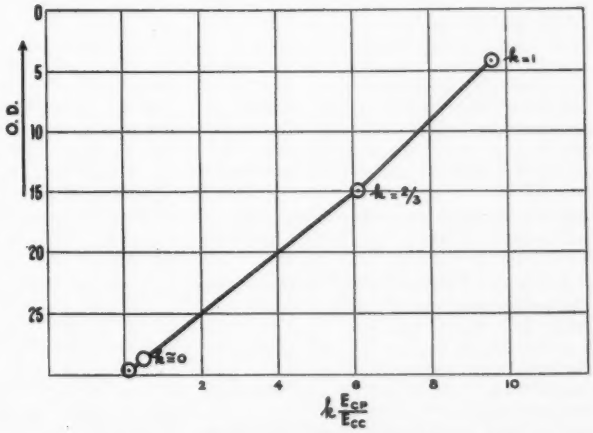


Fig. 10. Plot of degree of dispersion v. relative bond energies.

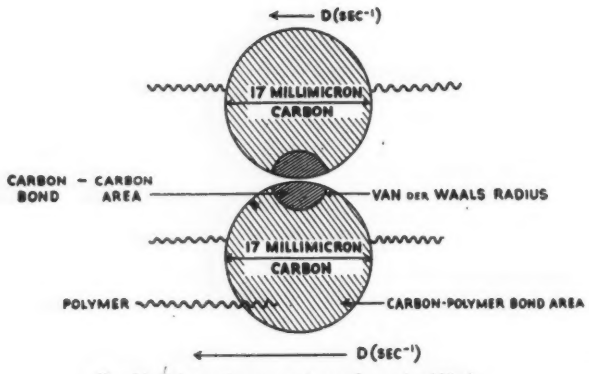


Fig. 11. Schematic comparison of van der Waals forces for two contracting carbon particles.

on each particle for carbon-polymer bonds to that available for carbon-carbon bonds both at 8 kilocalories per mole is roughly 30 to 1. These areas are represented in Figure 11, in addition to a typical van der Waals bond between carboxyl and hydroxyl groups on adjacent carbon particles. Insertion of these modifications into equation (1) yields the following revision:

(2) $d = \alpha\, kr\, (E_{cp}/E_{cc}) + b$

where α = a proportionality constant for the dispersion scale employed

k = the fraction of oxygen on the carbon surface

r = the ratio of the areas of carbon-polymer attraction and carbon-carbon attraction

kr is a constant for any one carbon black dispersion

$E_{cp} = E_{cc} = 8$ for O- - - -H bonds, or $d = \alpha\, kr$

b = the intercept

A plot of this equation, **kr** versus **d**, produces a line with a slope similar to that in Figure 10.

The actual situation in plastic dispersion may be a composite of these two models, with the latter model always present and the chemical bond model also present to a degree dependent on dispersion conditions.

References

1. Dannenberg, E. M., Jordan, M. E., and Stokes, C. A., *India Rubber World*, 122, 663–671 (1950).
2. Maibauer, A. E., and Myers, C. S., Polyethylenes. *Transactions of the Electrochemical Society*, 90, 341 (1946).
3. Wallder, V. T., Clarke, W. J., DeCoste, J. B. and Howard, J. B., Weathering Studies in Polyethylene for Wire and Cable Applications, paper presented before the Division of Paint, Varnish and Plastics Chemistry of the A.C.S., Detroit, April, 1950.
4. Gusman, S. and Stroup, J. D. Deterioration of Synthetic Enamels I. Absorption of Solar Energy. Paper presented at the Cincinnati Meeting A.C.S., Division of Paint, Plastics and Printing Ink Chemistry, April 1955.
5. Syrkin, Y. K., and Dyatkina, M. E., Structure of Molecules and the Chemical Bond, 240, Interscience, New York, 1950.
6. Beachell H. C., and Nemphros, S. P., *J. Polymer Science*, 21, 116 (1956).
7. Madorski, S. L., Rates of Thermal Degradation of Polystyrene and Polyethylene in a Vacuum. Circular 525, 221–235, Nov. 1953. U.S. National Bureau of Standards.
8. Sun, K. H. Effects of Atomic Radiation on High Polymers. *Modern Plastics*, p. 146, September 1954.
9. Szwarc, M. The Action of Carbon Black in Stabilizing Polymeric Materials. *J. Polymer Science*, 29, 589 (1956).
10. Loebner, E. E. Thermoelectric Power, Electrical Resistance and Crystalline Structure of Carbons. Dissertation, Graduate School, University of Buffalo, May 1955.
11. Studebaker, M. L., Huffman, E. W. D., Wolfe A. C., and Nabors, L. G. Oxygen-Containing Groups on the Surface of Carbon Blacks. *Industrial & Engineering Chemistry*, 48, 162 (1956).
12. Schaeffer, W. D., Smith, W. R., and Polley, M. H. Structure and Properties of Carbon Black. Changes Induced by Heat Treatment. *Industrial & Engineering Chemistry*, 45, 1724 (1953).
13. Syrkin, Y. K., *ibid.* (5) p. 276.

Patent Review

The following abstracts have been made from specifications at the Patent Office, with the permission of the controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 3s. 0d. each (including postage).

B.P. 764,242. Method of producing thermosetting phenolformaldehyde resins. To: Th. Goldschmidt A.G. (Germany).

Light coloured or completely colourless thermosetting phenol resins stable to light are obtainable when phenols or their homologues are condensed together with aliphatic halogen compounds, having readily exchangeable halogen atoms, and aldehydes in the presence of an alkali.

B.P. 764,301. Polymers prepared from acrylonitrile. H. W. Coover, Jr. To: Kodak Ltd. (U.S.A.).

B.P. 764,330. Composite plastic structural unit and manufacture thereof. To: Farbenfabrik Bayer A.G. (Germany).

A light-weight load-bearing unit, comprising a core of a foamed polyurethane composition united to a covering layer of an unsaturated polyester resin.

B.P. 764,355. Process for producing thin walled tubes from normally crystalline polymers. To: Dow Chemical Co. (U.S.A.).

A tube of fused normally crystalline vinylidene chloride polymer is extruded downwardly into a cooling bath wherein it is supercooled. The tube is filled with mineral oil to maintain its diameter. The tube is withdrawn by pinch rolls at a faster rate than it is extruded, the rate dependent on the desired final shape.

B.P. 764,381. Heat resistant synthetic resins. To: United States Rubber Co. (U.S.A.).

Refers to glass fibre reinforced heat resisting panelling or laminates for aircraft (heat ducts, radomes). The resin is a Knapp fusible alkyd type resin.

B.P. 764,398. Float for fishing nets. A. Kvist.

The float is formed of two cup-like parts joined together. Each one has a central piece of pipe integral with the cup. Both pieces of pipe are joined at their inner end and the joints of cups and pipe sealed.

B.P. 764,604. Book-rests. E. H. P. Cave, A. E. Wiles.

For reading in bed with side arms connected by an arch carrying the book support.

B.P. 764,605. Production of polymeric-x-chloroacrylate sheets. To: General Aniline & Film Corp. (U.S.A.).

For obtaining good thickness tolerances in polymer sheets, cast in relatively large cells made of thin and flexible cell walls.

B.P. 764,612. Method of manufacturing articles of synthetic resinous material. R. A. Shepherd. To: Belling & Lee Ltd.

When protecting a corrosive metal part to be inserted in plastic material by electroplating an intimate seal between the insert and the plastics is difficult to obtain. This drawback can be overcome by providing only part of the insert surface with protection by a non-corroding metal so that part of the plastic material (phenolic resins) is in contact with the base metal.

B.P. 764,721. Cured polyesterurethane castings. To: B. F. Goodrich Co. (U.S.A.).

B.P. 764,760. Apparatus for playing games. T. A. Lakeman.

A floating target for a water ball game.

B.P. 764,771. Closures for vacuum flasks or the like. To: Thermos (1925) Ltd. (U.S.A.).

For a vacuum flask with a pouring lip, a hollow stopper with a peripheral rim to snap over the bead of the pouring lip. The hollow stopper is provided with an independently removable cap so that the hollow space may be used as a receptacle, e.g. for sugar, cream, salt, etc.

B.P. 764,794. Bottle stoppers. To: Industria Nazionale Guarnisioni Ermetiche, Technoplastica S.R.L. (Italy).

A plastic wine bottle stopper to replace a cork and to be withdrawn by a cork-screw has the form of a circumferentially ribbed downwardly open cylinder closed on top. A centre depression in the closing end provides the grip for the cork-screw.

B.P. 764,950. Hypodermic injection sets. B. Bonet (France).

The flexible phial is of polyethylene formed with accordian folds.

B.P. 765,008. Closure adaptor for containers. To: Riecke Metal Products Corp. (U.S.A.).

The usual " combination plug " for metal drums and barrels is dispensed with by the use of an adaptor plug of a flexible plastic (polyethylene). The plug has an internally threaded recessed middle portion sealed on its underside by a membrane integral with the plug. The membrane is cut before inserting a faucet or a pump.

B.P. 765,029. Gramophone record. To: Radio Corp. of America (U.S.A.).

Contacting of the grooved areas of stacked records is prevented by making the label area slightly thicker than the grooved area which tapers from adjacent to the label area to a minimum thickness at the outer rim. As material, a copolymer of vinyl chloride and vinyl acetate (" Vinylite ") is preferred.

B.P. 765,039. Supports of synthetic material for self-adhesive labels. W. Hermann.

The support is provided with mutually adjacent protuberances of equal height so that the labels adhere only to the tops of the protuberances.

B.P. 765,063. Closures for vacuum flasks or the like. J. E. Wilson. To: Thermos (1925) Ltd.

For a flask with a pouring lip of polythene which is slipped over the neck of the flask and reaches with an outer flange under the shoulder of the casing. The closure is made of a hollow resilient plastic body (polythene) inserted as stopper and secured under an internal bead of the pouring lip. It carries an independently removable lid on top.

B.P. 765,095. Spectacle frames. S. Unger.

With sides following a sinuous curve up and down extending to the ear.

B.P. 765,209. Plastics extruder with mixing head. To: Frank W. Egan & Co. (U.S.A.).

The mixer consists of a central toothed shaft portion attached to the feeding screw and ending in a cone towards the extrusion opening. Toothed planetary rolls with conical ends are arranged around the toothed shaft meshing with the teeth of the shaft and the interior teeth of the surrounding fixed casing. For mixing, blending and homogenizing between feeding screw and extrusion with a minimum of back pressure.

B.P. 765,294. Method of producing hollow objects of a thermosetting resinous material. To: Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek Ten Behoeve van Nijverheid, Handel en Verkeer (Netherlands).

Glass fibre reinforced polyester tubes but also other hollow objects of varying shapes are formed over a polyvinyl chloride mould. This mould has been expanded in a mother mould at a temperature above its softening point and is then cooled in expanded state. During curing of the object the mould is again heated whereupon it shrinks to its original non-expanded size (" elastic memory ") and can then easily be removed.

B.P. 765,344. Manufacture of resin-impregnated fibrous mats or other bodies. A. de Dani, A. M. Dobson, G. A. Warren. To: Fibreglass Ltd.

The preformed mat is sprayed with water, then powdered resinous material is fed from above on to the body whilst it is being vibrated.

B.P. 765,374. Thermoplastic synthetic resin-coated fabrics. Bernard Wardle (Everflex) Ltd., K. O. Berry.

For upholstering, car trimmings, panelling to be stretched in longitudinal and lateral directions. Polyvinyl chloride coated fabric is heated in a water bath to 95°C., then dried avoiding longitudinal tension.

B.P. 765,383. Apparatus for extruding plastic material. To: Farrel-Birmingham Co. Inc. (U.S.A.).

Refers to the support for strainer and cone plug at the extrusion aperture to be swung away from the cylinder for cleaning.

B.P. 765,401. Motor car with over-roof. To: Daimler-Benz A. G. (Germany).

Of transparent plastic material, e.g., an acrylic-acid ester.

B.P. 765,434. Bunion pads and the like. To: Scholl Mfg. Co. Ltd. (U.S.A.).

B.P. 765,452. Method for producing packages. V. Flax (France).

Two superimposed films (separate or single folded sheet) are deformed between the recessed faces of a pair of dies by air pressure. The faces of the films pressed together around the recesses are welded under heat so as to form closed or nearly closed containers retaining their shape after removal of the dies and the release of the air pressure. The containers are then charged and sealed.

B.P. 765,523. Sanitary coating composition. To: Stoner Mudge Inc. (U.S.A.).

An impervious coating for food and beverage containers which does not impart any off flavour or other undesirable characteristics to the contents. A mixture of vinyl chloride and vinyl acetate copolymers combined with certain phenolic resins.

B.P. 765,545. Method of treating plastic wax-like surfaces to render them receptive to printing ink, colours and the like. C. G. Lemon.

The surface of a polyethylene article, primarily as a thin film, is exposed to a high voltage glow or corona discharge along a narrow line for a time sufficient to modify the surface, which then becomes receptive (adherent) to printing ink, etc. The surface must not be over-exposed.

B.P. 765,562. Production of laminated articles. J. J. P. Staudinger, H. Williams. To: Distillers Co. Ltd.

Use of a bonding composition for impregnating absorbent material comprising an unsaturated polyester resin, styrene, polyvinyl chloride with vinyl acetate (10%). The mixture is cured at below 80 deg. C.

B.P. 765,563. Closures for containers. W. H. Brown, L. E. Brown.

A cap with a coaxial tubular skirt and an inner tubular slightly conical stopper portion as an integral polyethylene moulding.

B.P. 765,574. Adjustable bottle cap and brush holder. M. Moredith-Hardy.

The closure is domed and yieldable enabling the brush to be depressed towards the bottom of the bottle as the liquid level (glue, ink, nail varnish) falls.

B.P. 765,676. Bedpan-washing sinks. A. H. Adams.

With a cover of moulded plastic material.

B.P. 765,794. Moulding or sealing members. R. R. Hanson.

A strip of extruded polyvinyl chloride with a front face having rounded edges and a central longitudinal depression and a rear face with fine longitudinal grooves. A cement is applied to the rear face, then the strip is bent into angular shape in cross-section to be used as surround for baths and wash basins. Special corner members may be added.

B.P. 765,800. Matresses. W. Fillingham, Wall & Lee (Thermoplastics) Ltd.

Circular grommets formed by injection moulding as a cord guide and air vent.

B.P. 765,805. Gloves. W. Landauer, W. L. Berg.

With a polyvinyl chloride coating and a reinforcement in the vicinity of the thumb crutch.

B.P. 765,869. Children's toys. H. Fisher Page. To: Hilary Page " Sensible " Toys Ltd.

A straight spindle on the neck of a rubber sucker. The (plastic) spindle carries (plastic) playthings, e.g., beads containing rattling peas.

B.P. 765,878. Paint rollers. S. G. Hanson (Lambsdown Mfg. Co.).

The (plastic) rigid mounting sleeve carries a sponge rubber like core under a covering of sheepskin.

B.P. 765,897. Production of resin-impregnated bodies. To: Dow Chemical Co. (U.S.A.).

The body (wood, cardboard, concrete, bricks) is permeated by a gaseous nitrogen compound. It is then impregnated with a mixture containing an aldehyde and other constituents capable of undergoing a chemical condensation reaction in the presence of the nitrogen compound as a catalyst to form a solid resin at reaction temperature. Used, e.g., for wooden tanks resinified with a phenol-formaldehyde resin for storing an acidic aqueous iron chloride solution, for wooden propellers of exhaust fans in acidic fumes laden with hydrogen chloride and metal chlorides and other applications.

B.P. 765,899. Process for producing a moulded article from interbonded glass fibres. To: Owens-Corning Fiberglass Corp. (U.S.A.).

The glass fibres are assembled with fusible resin material in a cavity of the desired shape and compressed as a porous mass of light density while heated.

B.P. 765,961. Tobacco smoke filter elements. R. T. Crawford, J. B. Stevens. To: Eastman Kodak Co. (U.S.A.).

A cellulose acetate tow sprayed with a liquid plasticizer, condensed and shaped, then cut and stiffened by curing.

B.P. 765,962. Cellulose acetate tow. R. T. Crawford, J. B. Stevens. To: Eastman Kodak Co. (U.S.A.).

B.P. 765,963. Method and apparatus for the manufacture of tobacco smoke filter elements. R. T. Crawford, J. B. Stevens. To: Eastman Kodak Co. (U.S.A.).

B.P. 765,967. Means and method for compression moulding of plastics. To: Zenith Plastics Co. (U.S.A.).

Refers to deep drawing of reinforced laminated or fibreglass-impregnated resinous bodies. The maximum moulding pressure must be achieved before curing begins. The compression mould is heated and lined with fibrous reinforcing material. A viscid thermo-

setting resinous body is poured into the mould, which is then closed first rapidly with less force, thereafter slower with a force equal to final moulding pressure and in a time interval not extending beyond the commencement of gellation of the resin. The hydraulic press used has two independent means for delivering large fluid flow at low pressure and small fluid flow at high pressure.

B.P. 766,082. Covers for feeding bottles. J. Garcin (France).

A resilient (rubber; plastic) cover preventing contact with the hot glass. The cover is provided with a sound-producing device and may have the appearance of a toy animal.

B.P. 766,106. Table tennis bat and method of assembly. H. L. Sistrunk.

Thick finger and thumb rest areas on a special hand-conforming grip moulded in one piece of plastic material.

B.P. 766,117. Wrist watch guard. E. A. Spencer.

Of polythene or "Perspex" covering the watch and also the winding button. It has two slots for the straps.

B.P. 766,139. Manufacturing process for the production of porous moulded bodies made of synthetic resins and moulding powder for use in said process. R. Biazotti, J. Lintner. (France).

Present methods result often in a very irregular texture of the moulded bodies. Polymerization in the mould requires long heating times. In the new process the moulding powder is prepared by covering grains of a soluble material (salt; sugar; dextrin) with a thin layer of resin. This preparation can be used in exactly the same way as ordinary moulding powder. The soluble material is eliminated from the finished moulded mass by an appropriate solvent.

B.P. 766,154. Boards or panels for holding a number of integers. H. H. Fisher Page. To: Hilary Page "Sensible" Toys Ltd.

A board with upstanding ridges is made of a flexible material so that flat (plastic) cards can easily be inserted or removed without sliding them over the ends of the board.

B.P. 766,165. Closures for containers. To: Metal Box Co. Ltd.

The closure includes a transparent or translucent (polythene) measuring container extending from the interior of the crown of the closure. A flange on the measuring container serves as a seal between closure and neck of the main container.

B.P. 766,181. Process for producing patterns resembling watermarks in foils of polyvinyl chloride and similar plastic materials. To: Farbwerke Hoechst A. G. vormals Meister Lucius & Bruning (Germany).

In the production process, the foil is passed over heated rollers and then considerably stretched. When providing a heated roller with a low relief corresponding to the desired pattern the heat transfer at the raised portions is more intense the other part remaining somewhat matt. The stretching of the foil is carried out after the watermark treatment.

B.P. 766,254. Inflatable floats or buoys. To: Burnett & Jackson Ltd.

An inflatable bag secured to a separate closure member is fabricated from panels of plastics or plastic coated material. The panel edges are joined by heat and pressure. A sealing liquid may be introduced for temporary or permanent repair. The bag may be of highly polished or brightly coloured plastics to render the float readily visible.

B.P. 766,257. Coating of plastic material. S. T. Deakin. To: Edison Swan Electric Co. Ltd.,

Refers to the metal coating of polytetrafluoroethylene (P.T.F.E.) but also to that of materials like silicon resins. A block or sheet is formed of the powdered or granulated material by compression. The metallic coating is then applied so as to cause the metal to key into the spaces between the plastic particles. The coated and preformed material is then further compressed to the required dimensions, finally heat treated to effect setting.

B.P. 766,366. Holders for photographs, motor vehicle licences and the like. R. Aekerhalt, O. J. Bick.

With magnet means on the frame and an external (plastics) ornamentation.

B.P. 766,386. Process for the production of foamed polyurethane products of high molecular weight. To: Farbenfabriken Bayer A. G. (Germany).

B.P. 766,410. Method of making a detergent and solvent resistant sponge material. C. L. Wilson (U.S.A.).

Polyvinyl alcohol-formaldehyde sponges are given an after - treatment with certain dialdehydes.

B.P. 766,424. Production of synthetic resins. To: Diamond Alkali Co. (U.S.A.).

A high quality polyvinyl chloride can be produced by carrying out the polymerization reaction in the presence of a small controlled quantity of gelatin as the suspension stabilizer.

B.P. 766,429. Polyvinyl chloride resins. To: United States Rubber Co. (U.S.A.).

If a critical small amount of a butadiene is milled into polyvinyl chloride resin (2 to 5 parts into 100 parts) obtained by emulsion polymerization, the impact strength of the resin is increased many times over, while the other properties, tensile strength, etc., remain unimpaired.

B.P. 766,468. Handles. S. W. Burnham. To: Bulpitt & Sons, Ltd.

A two-part handle (support and grip) for cooking pots, kettles, etc. The support part is an arched flat strip with a thick midrib to be attached to the vessel. The flat part has a cut-out portion over which the grip can be slid longitudinally. The (plastic) grip has slotted portions on both ends and the flat strip fits into those slots in a certain position in which the grip can be secured, e.g. by a grub screw.

B.P. 766,523. Method and device for the production of seamless stoppers having sealing rings or ribs. To: Bunder-Glas G.m.b.H. (Germany).

The ribs are formed in a mould with resilient ring-shaped inlays which in compressed condition form the desired outline of the stopper. On removal of the moulding pressure, the inlays, owing to their inherent resilience, do not interfere with the withdrawal of the moulded body.

B.P. 766,550. Manufacture of artificial flowers and the like. A. J. Miller.

Petals are individually moulded from coloured thermo-plastic sheet material. They are assembled in the shape of the flower so that when bonded together inter-laminar spaces are provided for the transmission of light.

B.P. 766,585. Polystyrene plastic materials. F. Long, N. E. Williams. To: Monsanto Chemicals Ltd.

The process is carried out in three stages at different temperatures. In the first stage conversion is achieved of from 20 to 30%, in the second stage from 40 to 50%.

B.P. 766,608. Screw press for mixing and extruding thermo-plastic material. To: S. A. S. Lavorazione Materie Plastiche (L.M.P.) di M. I. Colombo & Co. (Italy).

A multi-thread central screw engages with screws having a smaller number of threads than the central screw. This arrangement promotes mixing of the material as the quantity that can be processed depends not only on the number of screws but also upon the total number of the inter-engaging threads.

B.P. 766,627. Synthetic resinous compositions. To: Midland Silicones Ltd. (U.S.A.).

Refers to silicone-alkyd resins blended with polyvinyl acetal resins as insulation for electrical conductors.

PROPERTIES AND TESTING OF PLASTICS MATERIALS

(*Continued from Page 142*)

Properties (28)

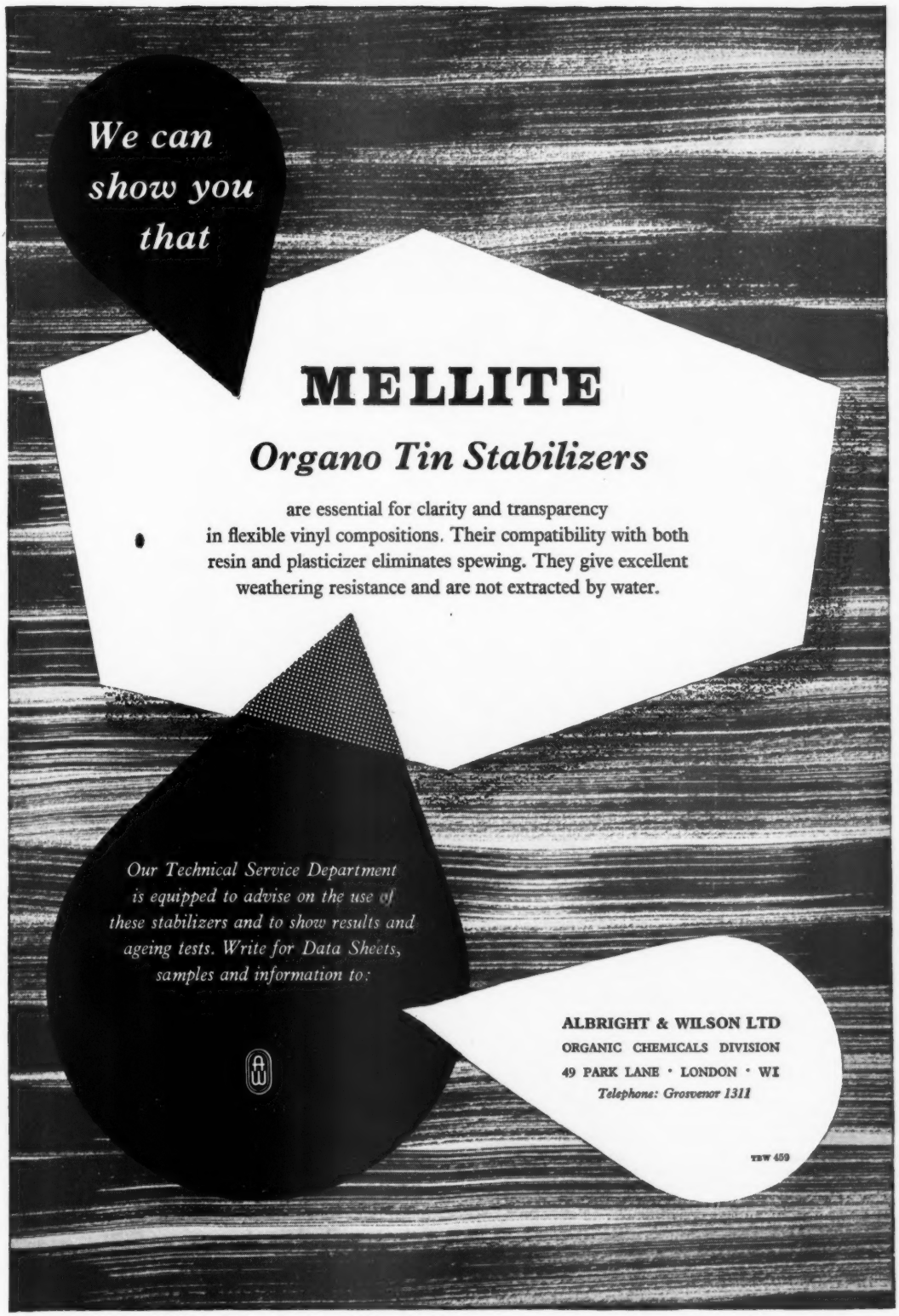
S.g.	1.31–1.34
Refractive index n_D	1.50–1.52
Hardness—Rockwell M	95–117
Tensile strength p.s.i. 25° C.	5–13,000
Modulus of elasticity in bend p.s.i. $\times 10^3$	160–250
Compressive strength p.s.i.	22–27,000
Impact strength (Izod) ft. lb./in.	0.3–0.6
Thermal conductivity c.g.s.	0.0005
Water absorption %	0.2–0.4
Dielectric Constant 10^6 c/s	3.6
Power Factor 10^6 c/s	0.057
Dielectric strength (short) v/mil.	570

Phenol-Aldehyde resins

One Specification has been published (26) for boards, tubes and cylinders.

References

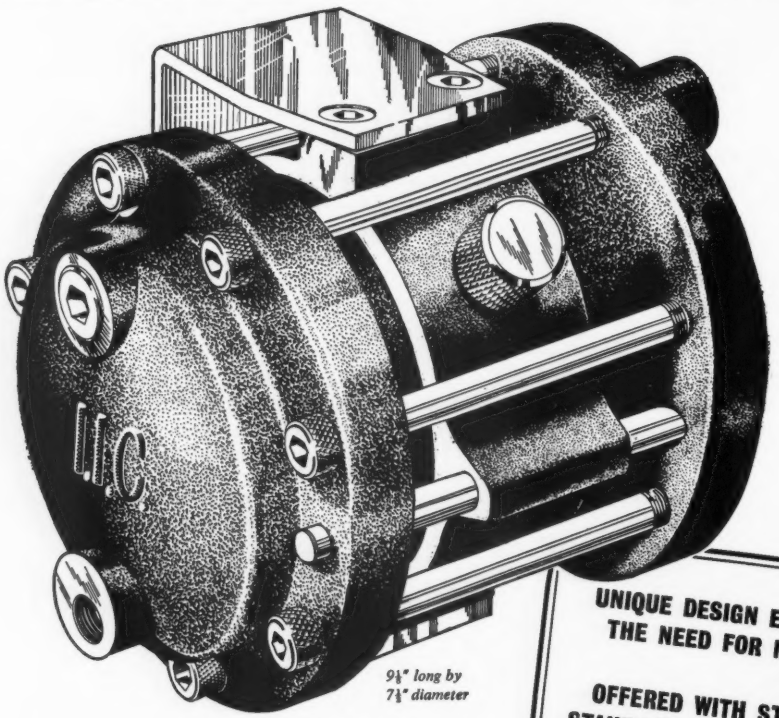
1. *Trans. P.I.*, 1952, **20**, 29.
2. *Plastics* (Lond.), 1952, **17**, 355.
3. B.S.1322–1946.
4. *Trans. P.I.*, 1949, Oct., 56.
5. *Plastics* (Lond.), 1952, **17**, 287.
6. A.S.T.M. Spec., D.956–51.
7. B.S.771–1938.
8. A.S.T.M. Spec., D.494–46.
9. A.S.T.M. Spec., D.700–52T.
10. Phenolic Resins–Iliffe & Sons Ltd., 1950.
11. B.S.1254–1945.
12. A.S.T.M. Spec., D.834–49.
13. *J. Appl. Chem.*, 1953, **3**, 328.
14. Symp. on Plastic Testing—A.S.T.M., 1952.
15. *Trans. A. S. Mech. Eng.*, 1945, **67**, 253.
16. A.S.T.M. Spec., D.704–51T.
17. B.S.1321–1946.
18. *Trans. P.I.*, 1952, **20**, 37.
19. Mod. Plast. Ency., 1954.
20. *Paint, Oil Chem. Rev.*, 1949, **23**, 18.
21. Plastics Eng. Hand.—S.P.I., 1954, and *Plastics* (Lond.), 1951, **16**, 91.
22. *Trans. P.I.*, 1953, **21**, No. 46, 5.
23. A.S.T.M. Spec., D.705–49.
24. *Trans. P.I.*, 1950, **18**, 1.
25. I.C.I. Ltd.
26. B.S.1474–1932.
27. A.S.T.M. Spec., D.819–50.
28. Symp. on Plastics—A.S.T.M., 1944.


We can show you that
MELLITE
Organo Tin Stabilizers
are essential for clarity and transparency in flexible vinyl compositions. Their compatibility with both resin and plasticizer eliminates spewing. They give excellent weathering resistance and are not extracted by water.
Our Technical Service Department is equipped to advise on the use of these stabilizers and to show results and ageing tests. Write for Data Sheets, samples and information to:
ALBRIGHT & WILSON LTD
ORGANIC CHEMICALS DIVISION
49 PARK LANE • LONDON • WI
Telephone: Grosvenor 1311
TBW 459

ANNOUNCING THE

I.I.C. Flowmeter

THE MODERN METHOD OF FLOW MEASUREMENT



9¼" long by
7½" diameter

Originally designed in the United States by the Industrial Instrument Corporation, the I.I.C. Flowmeter is now manufactured under licence in Great Britain by Elliott Brothers (London) Limited. It is offered as a measuring device in conjunction with Bristol's and Elliott recording, controlling and transmitting mechanisms to provide a complete range of flowmeter instruments.

- *Response speed: Full scale in less than one second.*
- *Sensitivity: 0·02 inches of water differential.*
- *Ranges: Same bellows unit for ranges from 0—20 to 0—500 inches of water. Changes required only in spring assemblies.*
- *Ambient temperature limits: —30° F to 200° F.*
- *Calibration: Accurate within ½ of 1% of scale.*

The I.I.C. Flowmeter will be exhibited at the Instruments, Electronics and Automation Exhibition at Olympia, 7th to 17th May 1957. Our engineers will be pleased to make you welcome at Stand No. 411.

UNIQUE DESIGN ELIMINATES THE NEED FOR MERCURY

OFFERED WITH STEEL AND STAINLESS STEEL BODIES FOR RATINGS UP TO 2,500 p.s.i.

PROTECTED AGAINST OVER RANGE UP TO FULL BODY RATING

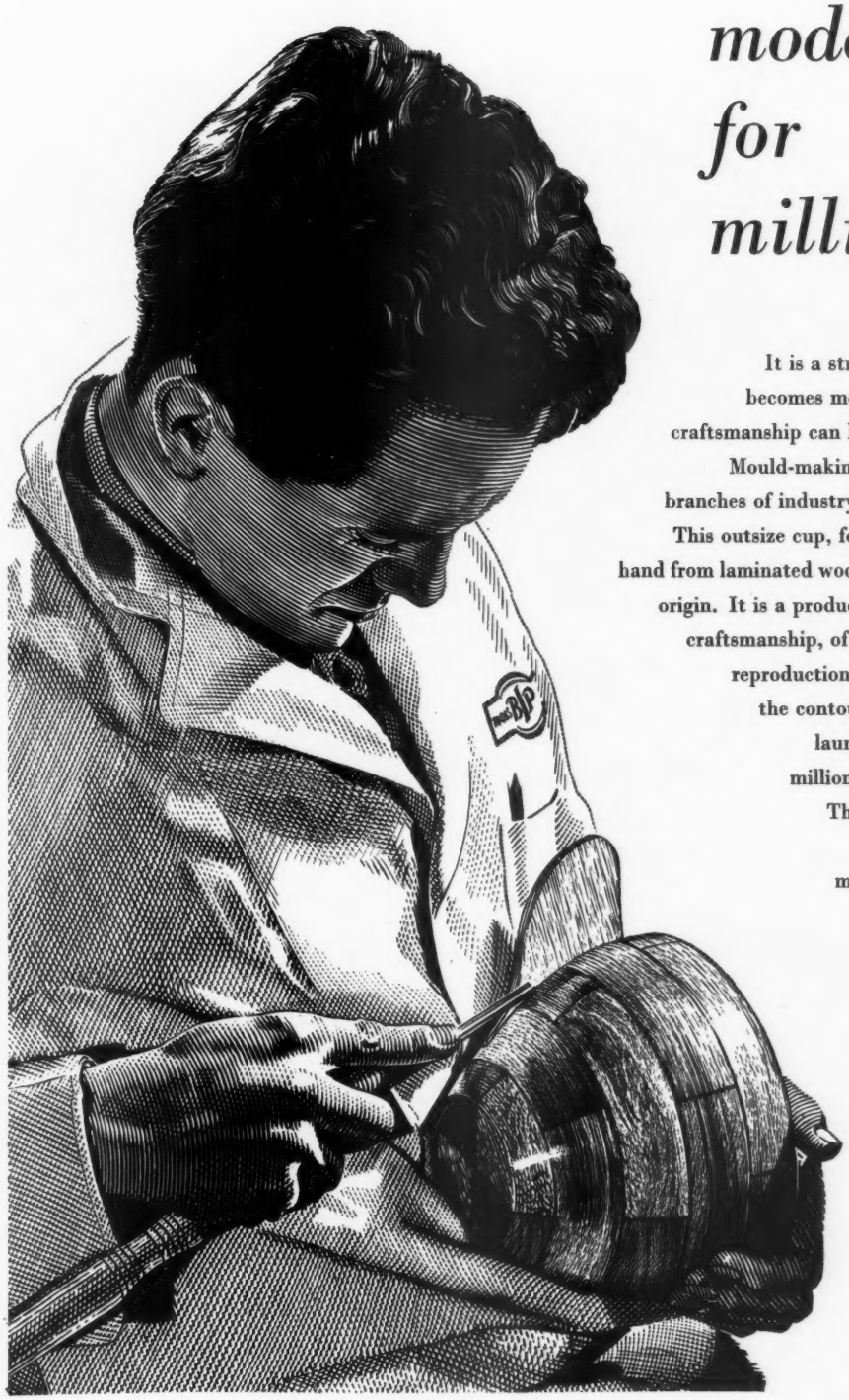
HIGH SPEED OF RESPONSE

ACCURATE AND SENSITIVE THROUGHOUT ENTIRE RANGE

ELLIOTT

Write for full details to:

ELLIOTT BROTHERS (LONDON) LTD.
CENTURY WORKS, LONDON S.E.13 TELEPHONES: TIDEWAY 1271 AND 3232



model for millions

It is a strange reflection that, as industry becomes more mechanised, the premium on craftsmanship can become increasingly emphasised. Mould-making is one of those small but basic branches of industry of which this is especially true. This outsize cup, for instance, is being modelled by hand from laminated wood with simple tools of traditional origin. It is a product of hand and eye, of controlled craftsmanship, of faultless precision. Scaled down reproduction from this master will determine the contours of the multi-impressions that launch in tens of thousands, or even millions, a new product on the market. That product will owe much to the personal skill of the individual model-maker and to the combined toolmaking skill of all the Craftsmen of Tyburn Road.

A cast will be taken from this wooden model to obtain a perfect reversal of the form, which comprises a cavity shape in the finished tool. The cast is then copied on a Pantograph machine.

B·I·P

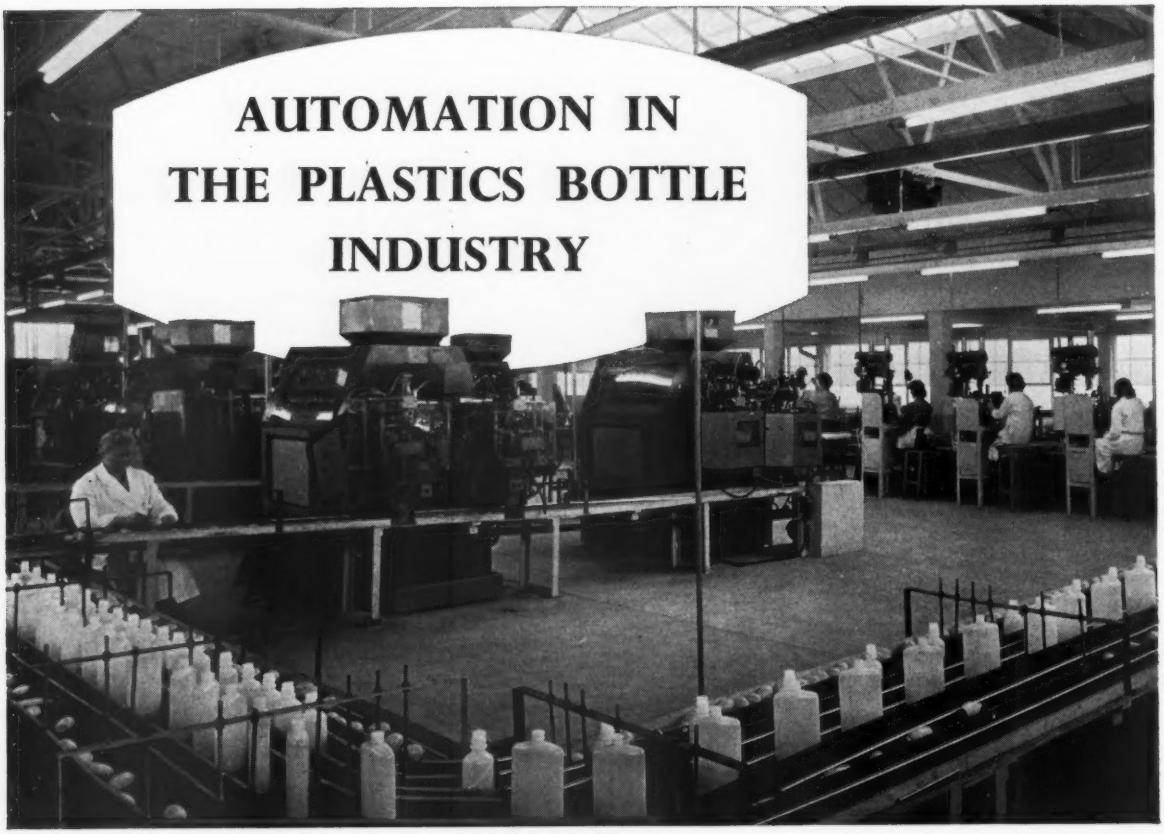
THE CRAFTSMEN OF TYBURN ROAD

B·I·P TOOLS LTD

Tyburn Road · Erdington · Birmingham 24 · *Phone:* Birmingham East 2061 · *Grams:* Plasmould Birmingham 24

MEMBER OF THE GAUGE AND TOOL MAKERS' ASSOCIATION

AUTOMATION IN THE PLASTICS BOTTLE INDUSTRY



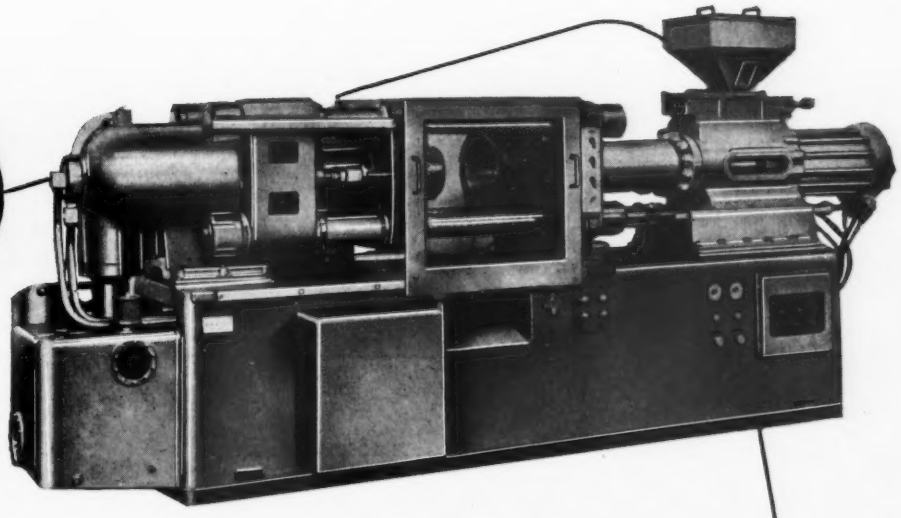
POLY-TAINER PROGRESS at our new factory at South Ruislip. Modern plant, fully automatic machinery together with our 'know-how' combine to give you the very best in Polythene and Nylon bottles.

Poly-Tainer Regd

Enquiries to INDUSTRIAL APPLIANCES LIMITED, 21-22J Grosvenor Street, London, W1 · Tel. GROsvenor 5976-8

Manufactured by E. Shipton & Co. Ltd., Ferndown Works, Northwood Hills, Middx. · Tel. Pinner 1103-5 (P.B.X.)

INJECTION MOULDING PRESSES



These machines mean BUSINESS for you

EXTRUDERS AND EQUIPMENT

VUOTOPLAST VACUUM FORMING

INJECTION PRESSES

All « NB » presses, like the NB. 360/520 shown here (12-19 oz.) are self-contained with the olidynamic power drive unit incorporated into the machines. The progressive electric system, featured by all « NB » presses, makes operation simplicity itself and cuts maintenance to a minimum. Main components are easily interchangeable. All machines are fitted with safety devices.

Injection presses "RAPID„ full automatic

NB & Co. are leading in automation of plastics equipment and are mass-producing the « Rapid » 1-2-4-6 ounce models, which operate by themselves on fully automatic fast cycling.

EXTRUDERS

« NB » single-screw extruders are available in « Standard » models with 30-45-60 mm. screw diameters; in the « TV » series, with built-in speed variator, with 45-60-70 and 90 mm. screw diameters. Screws and die heads are available in a wire variety of designs for all sorts of extrusion jobs such as: tubing, profiles, wire coating, monofilaments, and are completed by full equipments for the extrusion and blowing of P.V.C. and Polyethylene tubular films.

"VUOTOPLAST„ Vacuum Forming

Here is something really sensational !
« NB & Co. » introduce vacuum formers with patented movable and adjustable infra-red heater elements, that concentrate heat where it is most needed, thus ensuring constant cross-sections throughout the formed pieces and permitting extremely deep draws.
« Negri Bossi & Co. » build both, automatically operated machines as well as cheaper « Standard » models that, however, still maintain a high productivity level.

Write for detailed information and descriptive literature now! Address to:

Negri Bossi & C.
MILANO (ITALY)
44, CORSO MAGENTA
Cable address: "GIANIMAR„

NB&C

Papers for Industry

Base Papers for Plastics, Abrasives, Oil and Air Filters

Leathercloth and Impregnation or Coating

WIGGINS TEAPE have always been in the lead in developing special papers for industrial use. With their research staff and laboratories, quality control instruments on the papermaking machines, coupled with the skill and know-how of their papermakers, Wiggins Teape welcome enquiries for specialized industrial papers.

THE WIGGINS TEAPE GROUP

Gateway House 1 Watling Street
London EC4 · City 2020

HIGHLIGHTING
the new Polythenes

In this plastics' conscious age, G.E.C. technologists are at all times considering to what use can best be put the new developments in materials. With more than 40 years' experience in producing injection and compression mouldings for a wide range of industries at home and overseas, the G.E.C., backed by laboratory and test facilities, is at your service to give advice on your problems.

To meet M.O.S. requirements for improved heat resistance and increased impact strength at normal and low temperatures, the new rigid Polythene material is used for moulding the various component parts of the right-angled torch.

G.E.C.

moulded plastics for industry

THE GENERAL ELECTRIC CO LTD MAGNET HOUSE · KINGSWAY · LONDON · W.C.2

Are you extruding —

THIS IS——

Our Model PN.400 " Plasto " Haul-off

(World's Patents Pending)

It handles rigid P.V.C. tubing of from ½" to 2" diameter.

A Carter-Croft variable speed gear provides a wide speed range from zero up.

Counter-balanced Jockey Pulleys have ample weight adjustment.

This is the only " Haul-off " with the **power in the tank.**

The heavy gauge galvanized tank (6'0" long, 10½" wide and 9" deep), has a vertical adjustment provided by two 1" acme screws which are hand-wheel controlled and allow one operator to make any adjustment ranging within 5".

The six adjustable feet are fitted with shock absorbing rubber pads and provide for a further 4½" vertical adjustment.

When the feet are screwed upwards, four castors come into operation and enable one man to move the machine from one site to another.

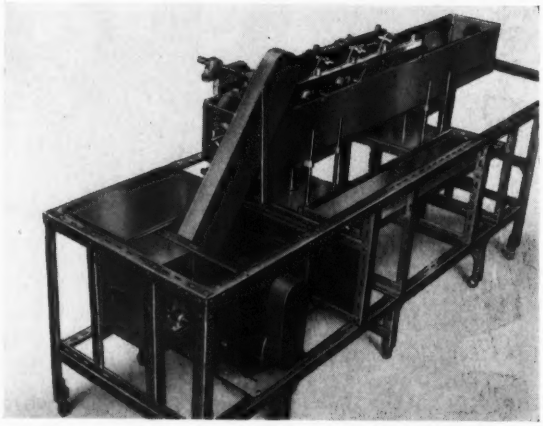
The very substantial grommets at each end of the tank are fitted with special washers to control leakage when the water in tank covers tube in work. An overflow and run-off pipe is fitted at one end of tank. The range of grommets are stored in operator's work tray at side of tank.

The main frame is constructed of Handy Angle to ensure light weight with maximum strength and clean appearance.

A " Warerite " work table is fitted at front end of tank.

The tank is fitted with eight guides to prevent rocking or spillage.

Overall length of machine is 8' 6" and it is 2' 4" wide.



Grams: Jiggentool, Luton, Beds.
Phone: Luton 6029.

PIECE - PARTS & ASSEMBLIES
112 MIDLAND ROAD · LUTON · BEDS

METALIN LIMITED

MANUFACTURERS OF A LARGE RANGE OF

CADMIUM COLOURS

which are specially suitable for use in the PLASTICS INDUSTRY where...

- **HEAT STABILITY**
- **LIGHT FASTNESS &**
- **STRONG COLOURING POWER**

are of prime importance.

We have specialized in the manufacture of these pigments for many years and the benefit of our experience is at your service.

Telephone : Bletchley 2526

THE CHEMICAL WORKS, BLETCHLEY, BUCKS

Ashdowns have the answer. . .

New Imperial Typewriter Case

THIS WAS IMPERIAL'S PROBLEM

The case plays a big part in prolonging the life of a portable typewriter. This is particularly true of Imperials because so many are exported to tropical countries where conditions are severe. It was found that neither wood nor metal were really satisfactory. Travel, excess heat and moisture, tropical pests, all pointed the need for an entirely new sort of case.

THIS WAS ASHDOWNS ANSWER

From the very beginning Ashdowns collaborated in the design and produced a new case in material never before used for that purpose—a fibreglass reinforced plastic.

The new case is light yet stronger than steel. It costs no more than the old one. The surface is both self coloured and self patterned. This means that no after finishing is needed, no ugly scratches mar the surface. The case is proof against corrosion and tropical pests, is pleasing to the eye and is always pleasant to handle.

The new case for the Imperial 'Good Companion' 3 sets a new standard in quality and design for all portables.

ask Ashdowns

If there's an answer in plastics for your problem—and there probably is —Ashdowns will find it for you. Call them in at the earliest planning stage. It will save weeks of work later on.

Makers of 'ASHLAM'* laminates, glass fibre reinforced laminates and mouldings, 'UNDULITE'* reinforced fibreglass translucent sheeting, 'Formene' G.I. high impact polystyrene sheet and vacuum formed thermoplastic sheet fabrications.
Ashdowns Limited is a subsidiary of Pilkington Brothers Limited. * REGISTERED TRADE MARKS

ASHDOWNS LIMITED, ECCLESTON WORKS, ST. HELENS, LANCS. **Tel: St. Helens 3206**
LONDON OFFICE: 29/30 ST. JAMES'S STREET, LONDON S.W.1. TEL: WHITEHALL 6002

L

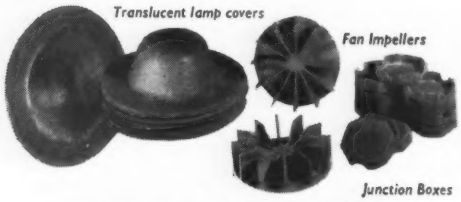
Backed by 20 years' experience in the manufacture of laminated plastics.

PERMALI LIMITED

Now offer

PERMAGLASS

Glass Fibre Reinforced Plastic Materials



MOULDINGS, SHEETS, TUBES ENCAPSULATION and CASTINGS

based on Polyester, Epoxide, Phenolic and Melamine resins

STRONG, LIGHT, DURABLE, WEATHER and CHEMICAL RESISTANT with GOOD DIELECTRIC PROPERTIES—PERMAGLASS offers WIDE SCOPE in DESIGNS, LOW TOOLING COSTS, RAPID PRODUCTION.

If you are looking for ways to make new and better products at low cost— get in touch with

PERMALI LIMITED

PERMAGLASS DIVISION

GLOUCESTER · ENGLAND

Tel: 24941 · Grams: 'Permali' Gloucester

London Office: 46 Victoria Street, S.W.1 · Tel: ABBey 6499

the junior rotary cutter

This machine will meet all demands for a really robust yet small granulating machine with a high performance. The Junior is provided with a large granule collecting bin and the rotor is driven through V-belts by a 1 H.P. motor mounted on the framework. The machine is quiet in operation and has been designed to ensure easy cleaning and maintenance. If desired the unit can be supplied suitable for bench or mobile mounting. The Junior Rotary Cutter is produced by specialists in the cutting of plastics and is one of the range of well-known Masson Rotary Cutters. Please write for further details.

BLACKFRIARS ROTARY CUTTERS LTD.

Blackfriars House, New Bridge St., E.C.4

Telephone: FLEet Street 6383

TUMBLEMIX

Result of a recent survey

Our publicity department recently conducted a survey into the merits of our Tumblemix Blending Units as used by leading plastic manufacturers. The following extracts are taken at random from our reports:—

Mixing 1½ *cwt. p.v.c.* (*natural*) *with approximately* 8½ *oz. dry colourant. Time taken,* 5–10 *mins. Varies slightly according to shade being mixed. Customers' comment—very satisfactory.*

Mixing 100 *lb. of polythene with* 1% *dry colourant or* 112 *lb. polystyrene with* 1% *dry colourant. Time taken,* 15 *mins. Customers' comment—very satisfactory.*

Mixing 56 *lb. of I.C.I. alkathene* (*natural*) *with* 168 *grams dry colourant. Time taken,* 10–20 *mins. Customers' comment—most effective.*

Mixing 56–60 *lb. of polythene and p.v.c. with* 2 *lb. dry colourant. Time taken,* 5 *mins. or a little less. Customers' comment—satisfactory.*

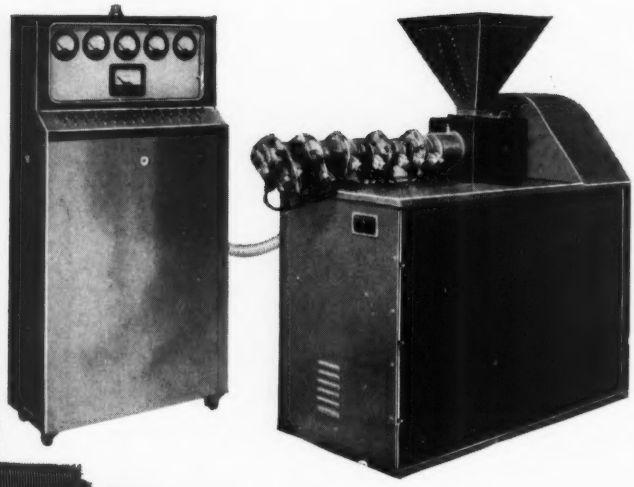
Leaflet available on request

P. & L. MILLER LTD.

HENEAGE STREET, BRICK LANE, LONDON, E.1

Telephone BIShopsgate 7314 (5 lines)

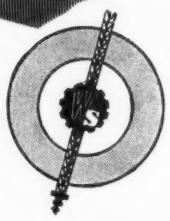
Make it better and faster with a W.S. Extruder



W. S. ELECTRONICS (EXTRUDERS) LTD.

44, BRUNEL RD., EAST ACTON, LONDON, W.3. Phone: Shepherds Bush 7601 (10 lines) Grams: Seltric, Ealux, London

- 1½ to 3½ inch models available.
- Suitable for all thermoplastic material.
- Unique barrel and scroll design.
- And all ancillary equipment.



problems in profile . . .

Whatever your requirements in plastic extrusion—consult us with confidence.
Our experience is unrivalled.
Our resources are unlimited.
Our service is ungrudging.

P.V.C.–

- RIGID & FLEXIBLE
- POLYTHENE
- ACETATE
- POLYSTYRENE

TUFFLEX

C. & C. MARSHALL LTD.

PLASTRIP HOUSE
OAKLEIGH ROAD NORTH, LONDON, N.20

Telephone: Hillside 5041 (3 lines) Cables: Tufflex, London
Telegrams: Tufflex, Norfinch, London

Quality controlled 'deeglas'

in this all-plastic U.D. milk float

This all-plastic milk float, manufactured by Mickleover Transport Ltd. for United Dairies employs **deeglas** chopped strand mat as its sole reinforcing material.

All **deeglas** products, chopped strand mat, glass rovings and deeformat, are produced under a quality control system based on the requirements of BS.600 and BS.600R. This ensures the consistency so essential for perfect mouldings.

deeglas

Chopped strand mat and deeformat in standard and roof-lighting grades. Glass rovings.

Glass Yarns & Deeside Fabrics Ltd. 44-46 Kingsway, London, W.C.2
Telephone Chancery 7343 and 8257
MIR 8201

Shear Hardness
AND
Diamond Scratch Tester
FOR PLASTICS AND ORGANIC COATINGS

This precision built instrument determines the resistance of plastic materials, plastic coated and painted specimens to scratches, digs, scrapes and similar damage not classed as normal wear.

By means of a precision ground contour tool or a diamond tool the specimen is marked or scratched whereby a calculation can be made to determine resistance.

Send for illustrated leaflet.

FUNDITOR

FUNDITOR LIMITED 3 WOODBRIDGE STREET LONDON E.C.1 ENGLAND

BAND & CARTRIDGE HEATERS

for the
PLASTICS INDUSTRY

MICA-WOUND BAND HEATERS MADE FROM BEST QUALITY MATERIALS. SUITABLE FOR EXTRUDERS, DIES, BARRELS AND MOULDING PRESSES. LAGGING CASES ASBESTOS MATTRESS FILLED. OUR ENGINEERS WILL DISCUSS YOUR PROBLEMS ON SITE.

PHONE 52148 **GENRISTO** *LTD.* OSMASTON ST. NOTTINGHAM

.... trouble is, he's so keen on G.G.L that he keeps talking about their wonderful service even when you want to concentrate on something else. I quite agree that there's nobody like G.G.L. for Capstan Work, Pressings and Automatic Productions.... oh!
G·G·L

For quick service at the right price get in touch with:

GRIFFITHS, GILBART LLOYD & CO. LTD.

EMPIRE WORKS, PARK ROAD, BIRMINGHAM, 18. *Tel.*: NOR 6221.

CAPSTAN AND AUTOMATIC WORK AND SHEET METAL PRESSINGS, IN ANY METAL, ANY FINISH, ANY QUANTITY

300% PRODUCTION INCREASE

The Radyne Model H50 increases production up to 300%. This example of high productivity is found in the manufacture of moulded door knobs but is a typical performance of Radyne equipment. Output increases and outstanding economies in time and production costs are found in every field of application.

The Radyne H50 — a 6 kw Super Speed Plastic Pre-heater — has an oven capacity of up to 16 lbs of pellets and a heating rate of up to 4 lbs per minute.

Weight of Pellets	Heating time in seconds to reach			
	90°C.	110°C.	130°C.	150°C.
½ lb. (.23Kg)	9	14	21	26
1 lb. (.45Kg)	17	26	36	46
2 lbs. (.91Kg)	30	50	68	—
4 lbs. (1.8Kg)	55	95	130	—
10 lbs. (4.5Kg)	135	210	—	—

★ PRE-HEATS FASTER TO HIGHER TEMPERATURE
★ AUTOMATIC LID OPENING
★ HOT AIR BLOWER PREVENTS CONDENSATION
★ LARGE 12" x 14" ELECTRODES
★ SUPERB APPEARANCE
★ SIMPLE OPERATION

RADYNE 6kw PLASTIC PRE-HEATER

MODEL H50

radio heaters ltd
WOKINGHAM · BERKS · ENGLAND
Tel: WOKINGHAM 1030 (6 lines)

UCC

CHEMICALS FROM COAL

PHENOL: 39.5/41°C

CRESOLS: 60/64% meta content ortho, pure grade A

XYLENOLS: 1.3.5
2.4/2.5
5/7°
(specified cuts as required)

Enquiries to :-

UNITED COKE & CHEMICALS COMPANY LTD.

THE UNITED STEEL COMPANIES LTD (SALES DEPARTMENT 71) 34, Collegiate Crescent, Sheffield, 10

Telephone: Sheffield 63025 Telegrams: 'Unichem' Sheffield

UCC1

CUBAR

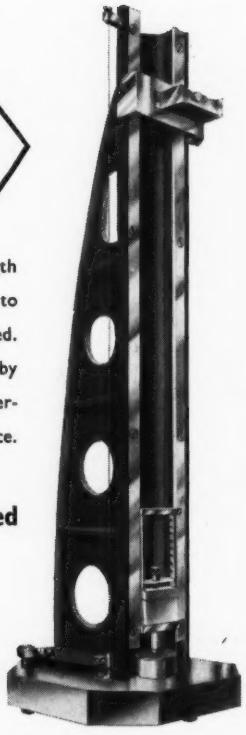
ROSSI PEAKES
FLOW TEST MACHINE
(PAT No 202118)

Designed exclusively for measuring the flow properties of thermosetting and thermoplastic materials of the polystyrene group. Pressure range attainable with standard set of weights 0–3,000 lb. per sq. in.
Each machine is calibrated and issued with a test certificate.

IMPACT TEST MACHINE

Enables the impact strength of Cellulose Acetate to be accurately determined. Manufactured exclusively by **Dunbar & Cook** with permission of the Post Office.

Write for illustrated leaflet to Dept. P.



DUNBAR & COOK LTD

DUNBAR & COOK LTD., NEW JOHN ST., BIRMINGHAM, 6
Phone: ASTon Cross 2571/2/3 Grams: "Cubar" B'ham.

IN THE FIELD OF

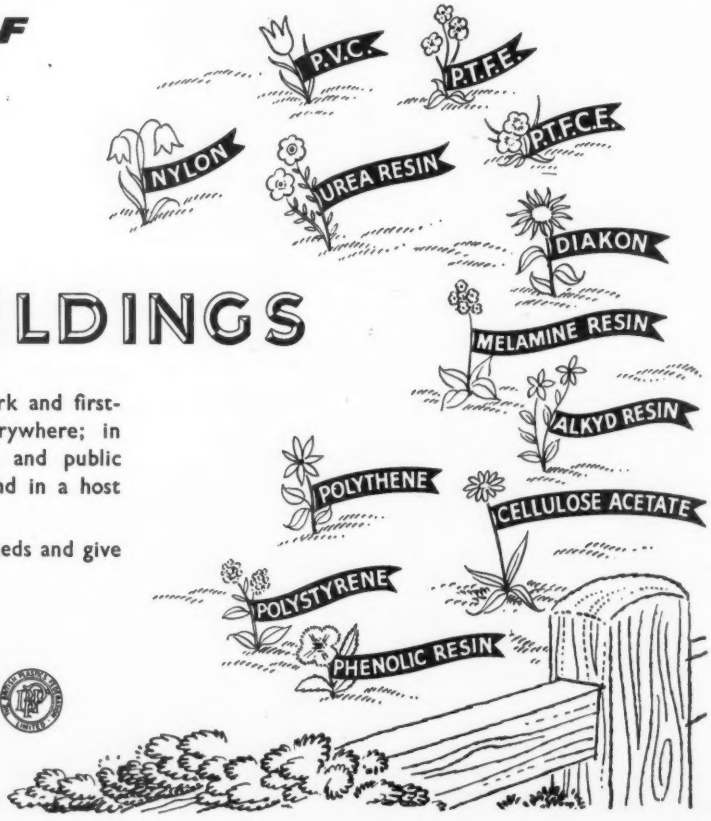
plastics

CONSULT

KENT MOULDINGS

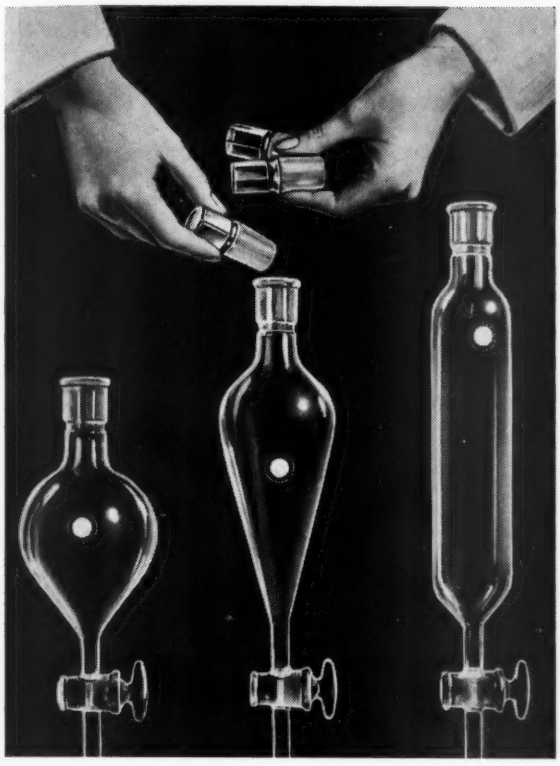
KM have a fine reputation for first-class work and first-class service. Their mouldings are used everywhere; in electrical and radio equipment; in aircraft and public services; in toys, sports and fancy goods, and in a host of other articles.

A KM engineer will gladly investigate your needs and give you reliable advice.



KM KENT MOULDINGS
PROPRIETORS HOLSTER BRANDES LIMITED

FOOTSCRAY · SIDCUP KENT
Tel: Footscray 3333



Which Stopper?
It doesn't matter!
They're interchangeable!!

'PYREX' Separating Funnels are increasing in popularity every day, and, with the many advantages they offer, this can readily be understood.

In the first place, every one of the wide range of sizes is fitted with a glass interchangeable stopper, ground to the recommended B.S. size (and, of course, easily replaceable).

Secondly, capacities of from 25 ml. to 20 litres are available.

Thirdly, the whole article is the product of the skilled Jobling Craftsman, thus ensuring complete satisfaction to the user.

Finally, and perhaps of greatest importance, these Funnels are made throughout of 'PYREX,' the original borosilicate glass, thus ensuring a high degree of heat-resisting strength.

● *Make certain that your Separating Funnels bear the 'PYREX' trade mark, and you will cut your replacement costs to the minimum.*

MADE IN ENGLAND PYREX GRIP-SEAL JOINT

'PYREX' REGD. TRADE MARK BRAND

THE BRITISH LABORATORY GLASSWARE

JAMES A JOBLING & CO LTD
Wear Glass Works Sunderland

THE ONLY MAKERS OF 'PYREX' BRAND GLASS IN THE UNITED KINGDOM

for HEAT CONTROL

the trend is to **WEST**

WEST *Instrument* LIMITED
(Associated with the West Instrument Corporation of Chicago)

OVER 50,000 IN USE THROUGHOUT THE WORLD

FULL SALES AND SERVICE

●

ENGLAND
Brighton
London
Birmingham
Manchester
West Country

U.S.A.
Nation Wide Coverage

CANADA
Nation Wide Coverage

Also Agents in
AUSTRALIA
NEW ZEALAND
BELGIUM
DENMARK
FRANCE
HOLLAND
GERMANY
NORWAY
ITALY
SPAIN
SWEDEN

MODEL JP SERIES
Proportioning Controllers

This time-proved unit is widely used for closer control than the basic On-Off system permits. JP *anticipates* temperature changes, tends to stabilise the system to desired temperature, makes new harder-to-mould materials a simple production job.

NO adjustments needed

NO valves to replace

—the IDEAL INSTRUMENT for

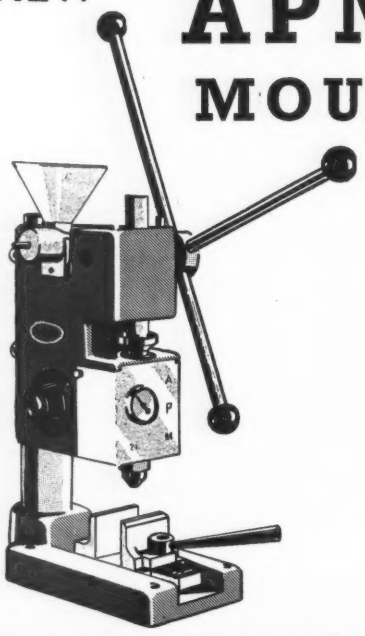
PLASTICS PRODUCTION

Gardsman
TEMPERATURE CONTROLLERS

Head Office and Factory: 52 REGENT STREET · BRIGHTON 1 · SUSSEX
TELEPHONE: BRIGHTON 28106

NEW

APM 21 HAND OPERATED BENCH INJECTION MOULDING MACHINE



★ SUITABLE FOR WORKING THERMOPLASTICS—CELLULOSE ACETATE, POLYSTYRENE, POLYTHENE, P V C, etc. with normal cylinder—NYLON with special cylinder.

★ FITTED WITH SEMI-AUTOMATIC HOPPER FEED.

★ CAPABLE OF PRODUCTION RATES, depending upon mould design UP TO 100 INJECTIONS PER HOUR WITHOUT SPECIAL SKILL.

AND TWO TOTALLY NEW FEATURES!

★ FITTED WITH NEW LEAK-PROOF, SELF-SEALING AND INTERCHANGEABLE CYLINDER UNIT (Patented).

★ CAPABLE OF ACCOMMODATING MOULDS OF VARYING SIZES IN NEW QUICK-ACTING CAMLOCK VICE.

ASMIDAR PLASTIC MOULDING MACHINES LTD.

5 RAMPAYNE STREET, LONDON, S.W.1 Telephone: VICtoria 5555 (3 lines)

Matched to your requirements

For screening, sorting or sifting heavy minerals or fine powders.
For filtering and processing liquids and semi-solids.
For restricting access and providing protection.
For improving presentation, the ornamental patterns add style and dignity to industrial design.

Please ask for Catalogue No. PS 858

'Harco' Woven Wire

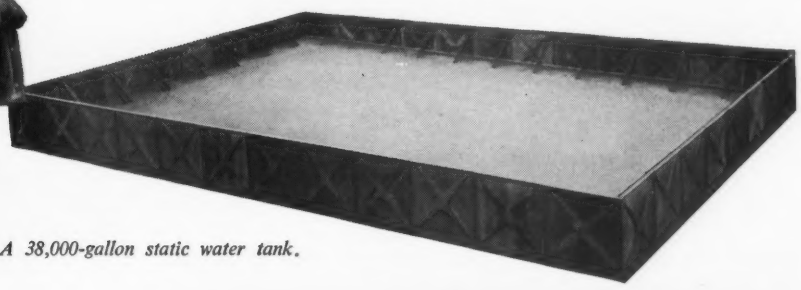
Harvey

G. A. HARVEY & CO. (LONDON) LTD.
WOOLWICH ROAD, LONDON, S.E.7
Telephone: GREenwich 3232 (22 lines)

Reinforced Plastic Mouldings

The light weight facilitates assembly.

Mouldings in Microcell glass fibre reinforced plastic combine light weight and high strength with complete resistance to corrosion and climatic extremes. Its inherent qualities have led to the production of sectional tank panels in this material.



A 38,000-gallon static water tank.

Microcell

Microcell Limited, Imperial Buildings, 56 Kingsway, London, W.C.2. Telephone: Chancery 3424 (10 lines)

M10 7603 eT

Craftsmen in Plastics

FABRICATING · FORMING · PRINTING

'PERSPEX' 'COBEX' 'DARVIC' 'BEXOID' 'CELASTOID' 'CELASTINE' 'CELLULOID' ETC.

ESTABLISHED OVER 25 YEARS

CELLGRAVE COMPANY LIMITED

ALPHA HOUSE

CHOUMERT ROAD

LONDON · S·E·15

Telephone: NEW X-0328

Telegrams: NEW X-0328

MILTOID SALES
DEPARTMENT

BX PLASTICS LTD.
A Subsidiary of the British Xylonite Co., Ltd.,

FOR

CELLULOID

BEXOID REGD.
CELLULOSE ACETATE

BEXOID OPTICAL SHEET

BEXOID FILM

BX POLYSTYRENE

COBEX REGD.
RIGID VINYL SHEET

VELBEX REGD.
FLEXIBLE VINYL

In clear transparent and industrial black sheet,
Velbex P.V.C. transparent beverage hose
and industrial hose

LAMPSHADE SHEET
IN BEXOID AND COBEX

AKULON (Nylon) RODS
Sole Distributors for the British Isles

34/36 ROYAL COLLEGE STREET · LONDON, N.W.1
PHONE EUSTON 4146/7 GRAMS: CELUDOL, NORWEST LONDON

T.A.10334

Makers of
Better Plastics
rely on

VICTOR BLAGDEN
CHEMICALS

for the Plastics Industry

PHENOL 39/41°

META CRESOL

Manufactured by
P. R. CHEMICALS LTD., Silvertown

FORMALDEHYDE

Manufactured by
The B.N.R. COMPANY, Barking

Enquiries to the Sole Selling Agents:—

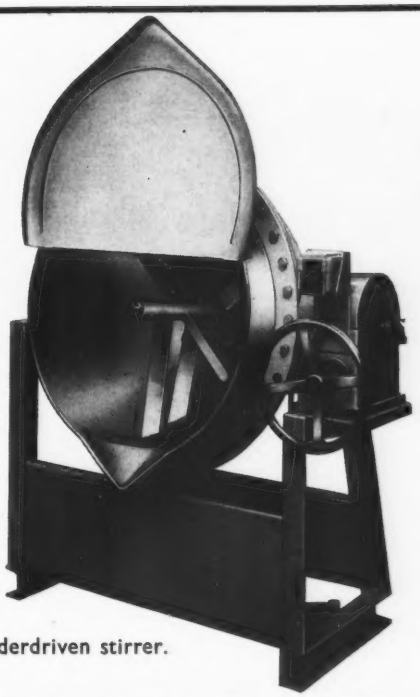
VICTOR BLAGDEN & CO. LTD.
PLANTATION HOUSE, MINCING LANE, LONDON, E.C.3
Telephone: MANsion House 2861 (6 lines)
Telegrams: BLAGDENITE FEN, LONDON
Norwich Union Building, City Square, Leeds. Telephone: 28236

STAINLESS STEEL FABRICATIONS

for the PLASTICS, FOOD & CHEMICAL INDUSTRIES

We invite your enquiries for jacketed pans, pressurized or vacuum vessels, mixers, trucks, conveyors and all manner of equipment in stainless or mild steels.

We will be happy to design and build special purpose plant and machinery to meet your specific requirements.



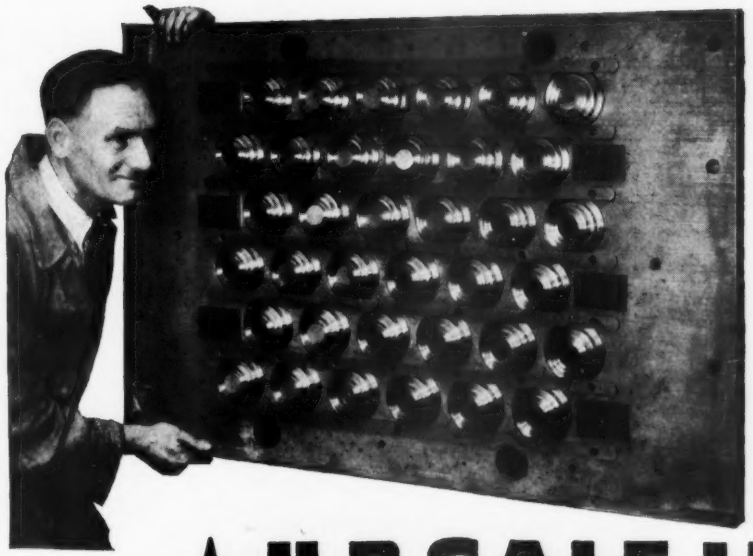
ILLUSTRATED: Stainless steel tilting jacketed pan with underdriven stirrer.

FREEMAN TAYLOR MACHINES LTD.

NECTON STREET . SYSTON . LEICESTER

Telephone: Syston 86907 (4 lines).
Telegrams: " Dyemac " Leicester.

Moulds by Experts.



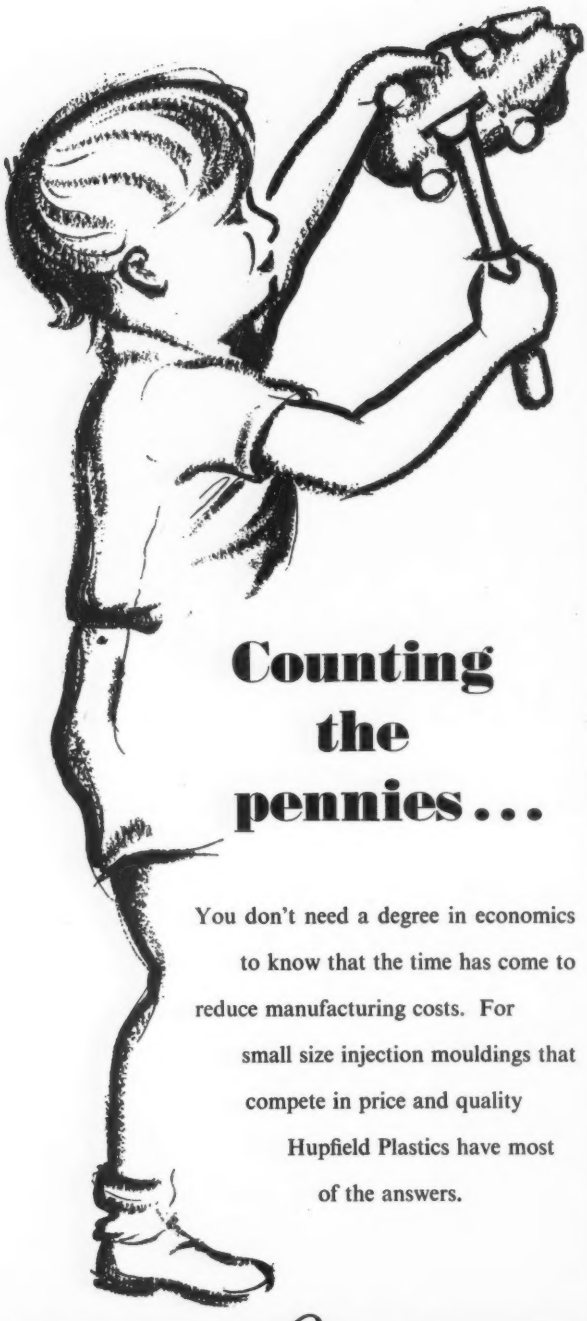
TOP PORTION OF 36 IMP. STRIPPER PLATE MOULD FOR 2¼" CAP CLOSURE WITH STANDARD JAR THREAD.

MOULDINGS ARE SPRUNG OFF THREADED PUNCH.

★H.B.SALE LTD.

PROGRESS WORKS, SUMMER LANE, BIRMINGHAM, 19

Established 1863 TEL.: CEN. 5661/3 GRAMS.: SALE, B'HAM Member of G.T.M.A



Counting the pennies . . .

You don't need a degree in economics to know that the time has come to reduce manufacturing costs. For small size injection mouldings that compete in price and quality Hupfield Plastics have most of the answers.

HUPFIELD PLASTICS
Limited
for
INJECTION MOULDINGS

47 OLD CHURCH LANE, STANMORE, MIDDLESEX

Telephone: GRImsdyke 305

MANDLEBERG

the name that distinguishes THE BEST PVC PRINTING

●

Mandleberg prints are produced by the latest American multi-colour process, acknowledged to be the best type of printing on plastic sheeting.

●

J. MANDLEBERG & CO.
(RUBBER) LTD.
SEAFORD RD. WORKS
PENDLETON
SALFORD 6
LANCS. ENGLAND

STEEL-SHAW jacketted

BALL MILLS

with porcelain linings

Successfully used for many years in the plastics industry, Steel-Shaw Ball Mills are your wisest choice for the grinding of plastic powders of all types. Speed, ease of operation, and efficiency, are but some of their attributes, which, from the manufacturer's point of view, mean increased productivity and top-quality products.

Robustly constructed and capable of staunchly withstanding the strain of constant use, Steel-Shaw Mills can be supplied in various sizes and fitted with discharge casings and insulated cooling jackets, if required.

" Steel-Shaw " ball mills are lined with porcelain blocks. Illustrated here with water jacket and discharge casing.

There's a STEEL-SHAW *answer to YOUR problem*

Write now for illustrated brochure

STEELE & COWLISHAW LIMITED

Head Office and Works: DEPT. 27
COOPER STREET, HANLEY, STOKE-ON-TRENT
Phone: Stoke-on-Trent 23333
London Office: 329 High Holborn, W.C.1 *Phone:* HOLborn 6023

scl.2099

Precision moulded

NYMOL

Registered Trade Mark

components in NYLON

Our trade names ' NYMOL ' and ' EXTRULON ' signify valuable achievements already assisting engineering designers to improve their products and save costs.

★

Our specialized knowledge always available for problems which ' NYMOL ' or ' EXTRULON ' parts may solve.

Extruded Nylon Rod

EXTRULON

for machine parts

We invite designers to consider NYLON early in development stages and to avail themselves of our acknowledged pre-eminence in a new field.

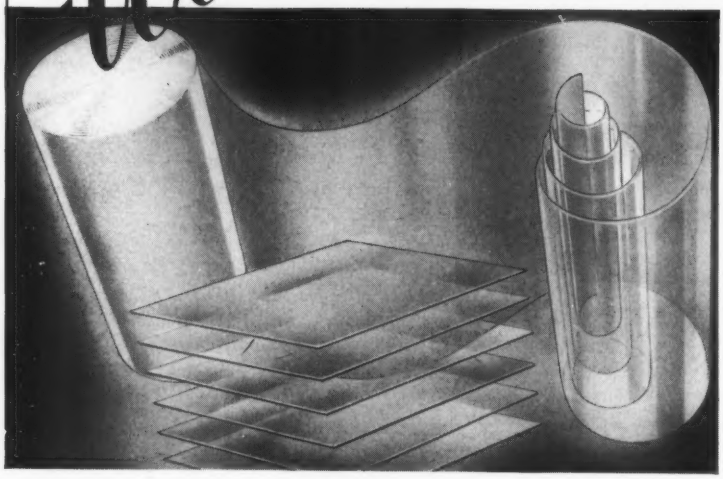
Plastic Engineers Limited

TREFOREST, GLAMORGAN

Telephone: Treforest 2371–2

Utilex

CELLULOSE ACETATE
sheets and films
SUITABLE FOR VACUUM FORMING



CLEAR TRANSPARENT
pol/pol or matt/pol

COLOURED TRANSPARENT
tinted

LAMPSHADE MATERIAL
matt or embossed

COLOURED OPAQUE
pol/pol or matt/pol

METALLISED
mirror-finished in silver and colours

INSULATING
dielectric qualities

UTILEX LIMITED *MILL STREET, KINGSTON-ON-THAMES. Telephone: KINGSTON 1660*

RIGID
AND FLEXIBLE
EXTRUDED

We manufacture a wide range of extruded Tubes and Sections in Rigid and Flexible P.V.C., Cellulose Acetate, C.A.B., Polystyrene and Polythene for numerous industrial applications.

If you are considering the use of PLASTIC EXTRUSIONS in your production programme, why not discuss your ideas with our Technical Representative, or send us a dimensioned sketch of the proposed section for our comments and advice. This service is free and without obligation.

TUBES
AND SECTIONS

MELWOOD THERMOPLASTICS LIMITED

Willoughby Road · Harpenden · Herts

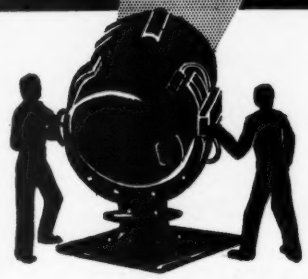
TELEPHONE: HARPENDEN 300

LONDON OFFICE: 49 LONDON WALL, E.C.2

TELEPHONE: MONARCH 6862

All correspondence to Harpenden.

'Ethypol' colours...



for POLYETHYLENE—

ETHYPOL DC for Dry Colouring.

ETHYPOL EX for Extrusion.

Supplied in BULK and UNIT packing.

Williams (HOUNSLOW) Ltd.

HOUNSLOW EST. 1877 **MIDDLESEX**

● *Telephone: HOUnslow 7766* ● *Telegrams: Williams, Hounslow*

M

Plastics, Scientific and Technological

BY H. R. FLECK

The third edition of this recognized standard work covers the scientific and technological aspects of the rapidly growing plastics industry. First principles are dealt with, but this is primarily a book for the senior student and experienced technician.

" The third edition of this standard work on plastics should be in every technical library."

THE TIMES REVIEW OF INDUSTRY

Third Edition, Medium 8vo. Illustrated **40s. net.** (*postage* 1*s.* 4*d.*)

Cellulose Acetate Plastics BY VIVIAN STANNETT

This is the first book to be devoted entirely to cellulose acetate plastics and has been written in such a way as to appeal to the general reader, the businessman and the technician. A chapter on packaging and container applications is included.

"An excellent contribution to the plastics literature."

CHEMICAL AND ENGINEERING NEWS.

Demy 8vo. Illustrated **30s. net.** (*postage* 1*s.* 2*d.*)

Moulds For Plastics BY W. M. HALLIDAY

This book deals with the problems associated with mould designing, construction, operation and maintenance with which the toolmaker in the plastics and pressure diecasting industries is likely to be confronted.

"An excellent reference for the designer, the toolmaker, production man and maintenance engineer."

MECHANICAL WORLD.

Demy 8vo. Illustrated **30s. net.** (*postage* 1*s.* 1*d.*)

From Booksellers or direct from the Publishers

TEMPLE PRESS LIMITED
BOWLING GREEN LANE, LONDON, E.C.1

JUSTOFLEX E.50
(EPOXIDISED SOYABEAN OIL)

JUSTOFLEX E.60
(EPOXIDISED COTTONSEED OIL)

EPOXIDISED ESTERS

STABILISER/PLASTICISER DISPERSIONS

METALLIC LAURATES, RICINOLEATES & STEARATES

LEAD PHOSPHITE DI-BASIC

ST JUST

THEODORE ST. JUST & COMPANY, LIMITED
WHITEFIELD, MANCHESTER, ENGLAND · Tel.: Whitefield 3211

PLASTICS FOR INDUSTRY?

RMP

HAVE the experience AND the equipment

Compression and Injection Mouldings
Sawn and Machined Parts
PERSPEX and P.V.C. Mouldings
Laminated Tubes, Angles and Channels

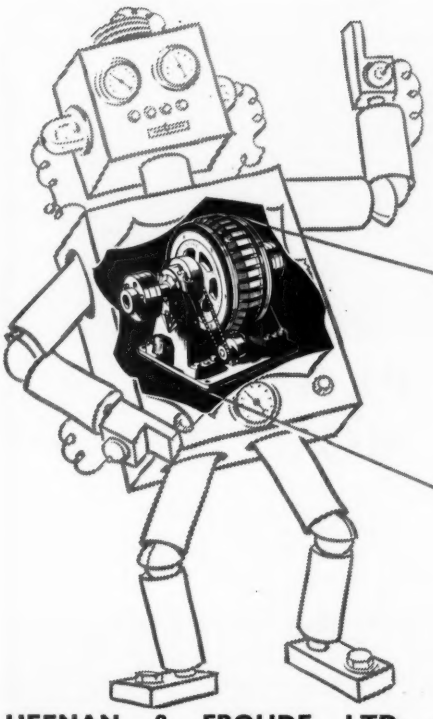
RESINOID & MICA PRODUCTS LTD
MARY ST · BIRMINGHAM 12 · Tel Calthorpe 1303
LONDON 28 Queen Anne's Gate S.W.1 Tel WHitehall 8892
One of the group of companies associated with the Southern Areas Electric Corporation Limited

At the heart of Automation will be—

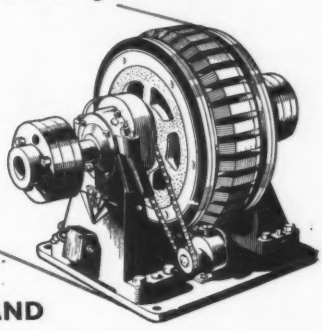
HEENAN-DYNAMATIC

Variable Speed

COUPLINGS



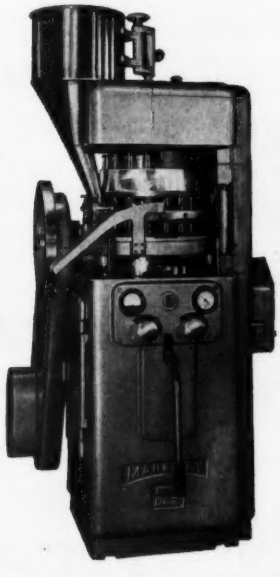
Innumerable examples in the widest variety of applications prove their versatility in solving almost any problem of controlled speeds, and response to almost any kind of signal



HEENAN & FROUDE LTD., ENGINEERS, WORCESTER, ENGLAND

MANESTY

DX2 ROTARY TABLET MACHINE



a NEW MODEL

FOR "SLUGGING" or PREFORMING

This machine is an addition to the Manesty range of rotary tablet machines and is particularly useful for "slugging" or preforming on account of its rugged construction, increased depth of fill and suitability for tablet diameters up to 1¾ in. Two types are available—one with 13 die stations up to 1½ in. diameter, the other with 16 die stations up to 1 in. diameter. Other features are: **Hydraulic overload device; Direct reading pressure gauge; Variable speed drive; Hopper with cut-off slide; New type cams; Built in Dust Extraction Nozzle; Completely enclosed.**

SPECIFICATION

Output (13 station model)	**143/286 per minute.**
Output (16 station model)	**176/352 per minute.**
Maximum diameter (13 station model) ...	**1½ in.**
Maximum diameter (16 station model) ...	**1 in.**
Maximum depth of fill (both types) ...	**1 1/16 in.**
Maximum working pressures (total) ...	**10 tons.**
Horse power of motor	**3 h.p.**

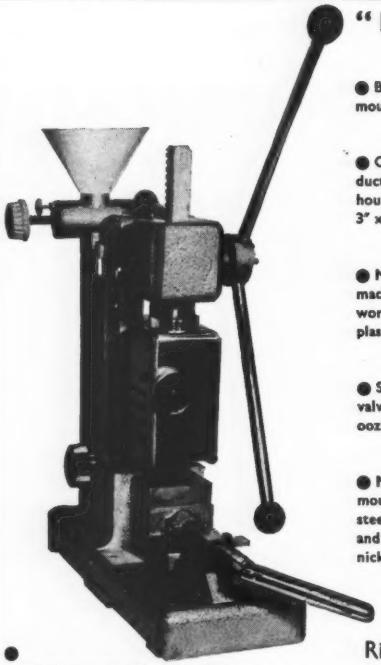
Full details on request.

MANESTY MACHINES LTD., 41, Evans Road, Speke, LIVERPOOL 19

Telephone: HUNTS CROSS 1972. *Telegrams:* MANESTY, LIVERPOOL, 19

TABLET MACHINES · PUNCHES AND DIES · MIXERS · GRANULATORS · COMMINUTORS · CONE MILLS

"PEPCO"



- Bench-type injection moulding machine.
- Capacity ⅛ oz. Production rate 120 per hour. Mould dimensions: 3" x 3" x 2".
- Most versatile machine suitable for working all thermoplastics including *nylon*.
- Special "non-drip" valve fitted, preventing oozing from the nozzle
- Most comprehensive mould service in stainless steel, nickel chrome steel and electro-formed hard nickel tools.

It is with considerable pride that we present our new model—an efficient bench-type machine which provides the answer to many day-to-day problems in industry.
The simplicity of operation, coupled with the low cost of moulds, makes this the most versatile machine of its kind on the market.

Ring TER 9648 for particulars

Manufactured by

PEPCO LTD.
21, SKINNER ST., E.C.1

TOOL MAKERS GAUGE & ALLIED TRADES ASSOCIATION

DESIGN & PRODUCTION CAPACITY AVAILABLE NOW

for small to medium sized

PLASTIC MOULDS

CIC

CHURCHILL INSTRUMENT CO. LTD.
14 WORDSWORTH ROAD
HARROW · MIDDX
TEL: HARROW 7733

Elm Plastics LIMITED

Solely Moulders to the trade, Tool Designers, Toolmakers, Injection Moulders, Slush Moulders, Vinyl Rotation casting and assemblers.

Styrene, Cellulose Acetate, soft, semi-rigid and rigid P.V.C., Alkathene and Diakon.

Nylon.

Elm Plastics Limited
RAINHAM, KENT
'Phone: Rainham, Kent, 81447

PHENCO

The modern flexible Vinyl-Plastic flooring

PHENWRAP

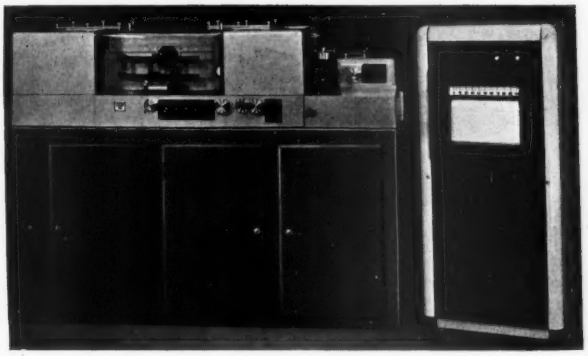
Dielectric and Sheathing Compounds & Wrappings for the Cable Industry

PHENCOFOIL
PHENAIR
PHENFLY

Films and light Textures for Aircraft

made by
PHOENIX RUBBER CO. LTD.

91 Bishopsgate, London, E.C.2. Phone: London Wall 1622 & 3564
Bristol Office: 39, Broad Street, Bristol, 1
Manchester Office: 472, Royal Exchange Buildings, Manchester 2



the H800 infra-red spectrophotometer

DELIVERY LESS THAN SIX MONTHS

This instrument is the most advanced of its kind for all forms of qualitative and quantitative analysis. It produces a pen-written record showing directly the spectra of the substances being tested. Prisms of glass, quartz, lithium fluoride, calcium fluoride, rocksalt, potassium bromide, and caesium bromide are available and are interchangeable one with another. The instrument can be used for double beam or single beam work and the resolution is high even at fast scanning speeds.

For full details write for catalogue CH 310/PC4

HILGER & WATTS LTD . 98 ST PANCRAS WAY, LONDON, NW1 . TEL: GUL 5636

Makers of precision optical instruments for analysis, measurement and inspection

TODAY, MORE THAN EVER INDUSTRY LOOKS TO ERMETO

for efficiency in pipe line systems

Whatever the field of application, whether it involves high pressures or very low pressure vacuum lines, ERMETO fittings are successfully withstanding the increased stresses imposed by higher industrial efficiency.

We shall be glad to send technical details on request.

ERMETO

REGD TRADE MARK

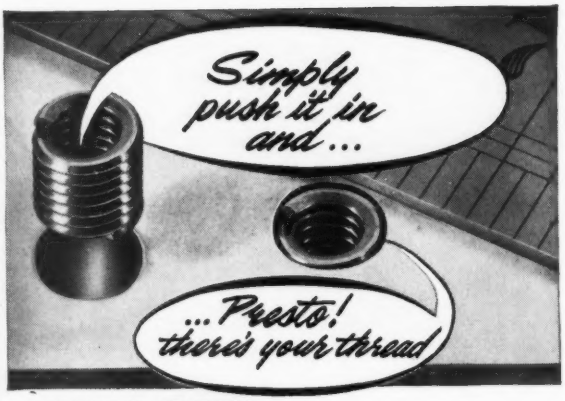
VALVES & COUPLINGS

BRITISH ERMETO CORPORATION LTD
MAIDENHEAD, BERKS
Telephone; Maidenhead 2271-4

AERASPRAY

Application of Polyester and Epoxy Resins and similar fluids by the Aeraspray model GTH.10 Catalyst Spray Gun gives greatly reduced production costs. 'Pot Life' and premature gelling are eliminated by keeping catalyst and resin apart until application takes place. Tests carried out by large resin manufacturers and users prove evenness of gell coupled with high speed application.

AERASPRAY ASSOC. LD. *Makers of Air Compressors, etc.*
Head Works, Nechells, Birmingham, 7. *Phones : EASt 1671-4, etc.*



HELI-COIL
REGISTERED TRADE MARK

PUSH-TYPE INSERTS

THE READY-MADE THREAD FOR MOULDED MATERIALS

Eliminate the need for solid bushings and tapping, use HELI-COIL PUSH-TYPE INSERT the ready-made screw thread for moulded and plastic parts, die cast alloys, powdered metals, all soft light materials and many hard metals. Pushed directly in drilled cast, or moulded, blind or through holes, this is the ideal low-cost, volume production, fastening method. A few shillings in tooling is all you need for up to 1,200 holes and more per hour.

For faster, cheaper production

Write for details to:
ARMSTRONG PATENTS CO. LTD., BEVERLEY, YORKS.

LY-BAK LIMITED
RUBBER & PLASTICS MANUFACTURERS

THERMOPLASTICS

Cellulose Acetate . Polythene . Polystyrene . Aceto-Butyrate P.V.C. and Co-polymer compounds . Polystyrene/Rubber compounds . "Semlux" Fibreglass products . "Plastiblox" Clicker and Rev Press Boards.

SOUTHERN INDUSTRIES AGENCY
(LONDON SALES OFFICE FOR THE GROUP)

SUITE 52 : 26, CHARING CROSS ROAD
LONDON, W.C.2. Telephone: Covent Garden 2538
" " " 1884

Virgin high acetyl and standard, cellulose acetate moulding powders. We are able to reprocess your redundant stocks and scrap into first class moulding powders. We would be pleased to make you an offer for your scrap. Prompt deliveries of virgin and reconstituted powders.

LET US SOLVE YOUR MATERIAL PROBLEMS—THERMOPLASTICS IS OUR BUSINESS
"LY-BAK PRODUCTS ARE GUARANTEED TO SATISFY"
SAMPLES AND SERVICE AVAILABLE UPON YOUR INSTRUCTION

PLASTICS

POLYTHENE, Polystyrene, Acetate and Perspex. We are sellers and buyers of these materials in any form.

GRANULATION and reprocessing plant available for:— Nylon, Cellulose Acetate, Polystyrene, Polythene and other Thermoplastic scrap. Materials ground to customers' requirements.

All enquiries to:—

John Castle & Co. Ltd.

5 HURLEY RD., LONDON, S.E.11
Phone: RELiance 4274/5

TRADE EMPIRITE MARK

Empire Plastics (BIRMINGHAM) Ltd

EMPIRE WORKS
BRUETON STREET
BIRMINGHAM · 4
Phone: ASTon Cross 2451

PLASTIC MOULDINGS FOR THE TRADE

Enter new and profitable plastics markets with THE VERSATILE

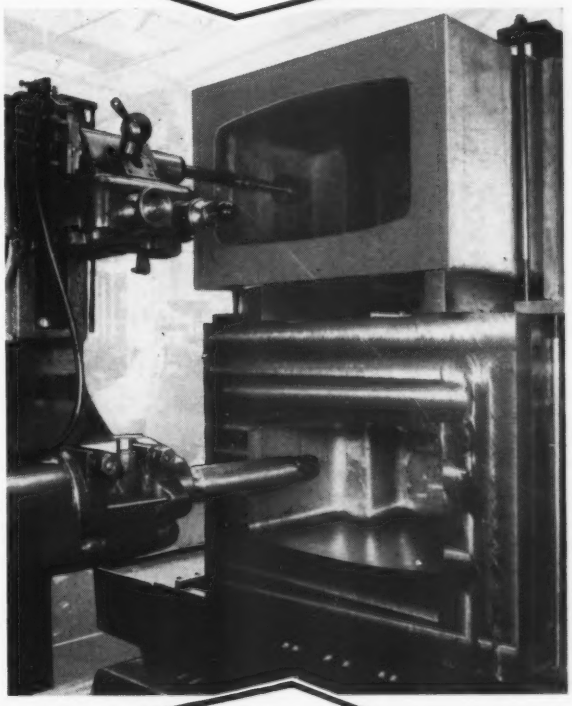
Redifon

JP12

Specially built for manufacturing a wide variety of plastic products of the larger type, the Redifon JP.12 permits multiple tooling on a scale hitherto impossible. It will produce consistently accurate welds for long periods over its entire platen area of 24″ × 18″. Write now for full details of this money-saving, money-making welder.

Industrial Electronics Division:
REDIFON LIMITED, BROOMHILL RD., LONDON, S.W.18. Tel: VANdyke 7281
A Manufacturing Company in the Rediffusion Group

Pioneers



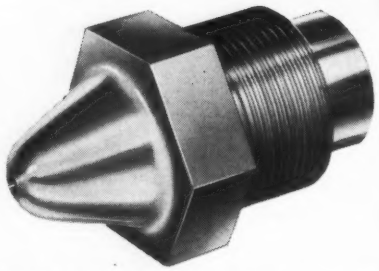
IN
MOULDS
FOR MODERN PLASTICS
ALSO . . .
JIGS AND GAUGES

DIE & TOOL MAKERS ASSOCIATION

BARBER & DUFFY LTD

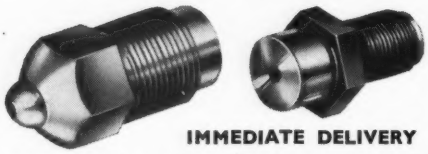
214/222 CARDIGAN ROAD, LEEDS
'PHONE : LEEDS 52033

THE NOZZLE SPECIALISTS!



Standard & Special nozzles for all machines

With or without screen packs
Write for price list



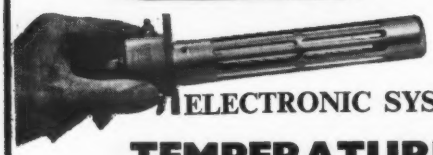
IMMEDIATE DELIVERY

EUCO TOOLS LTD. dept. p.l. **44 LONDON ROAD, KINGSTON, SURREY** phone: Kin 9029

ENGRAVING?
USE
"KARBO"
Tungsten Carbide
ENGRAVING CUTTERS
PRACTICALLY AS HARD AS A DIAMOND

ACCURATE
ADAPTABLE
INEXPENSIVE

TEM-CON



ELECTRONIC SYSTEM OF TEMPERATURE & HUMIDITY CONTROL

Sole manufacturers and patentees

P. A. M. LTD
MERROW · GUILDFORD · SURREY
One of the group of companies associated with the Southern Areas Electric Corporation Ltd

********* ✳ *********

CELLULOSE ACETATE PLASTICS

By Vivian Stannett

This is the first book to be devoted entirely to cellulose acetate plastics and has been written in such a way as to appeal to the general reader, the businessman and the technician. A chapter on packaging and container applications is included.

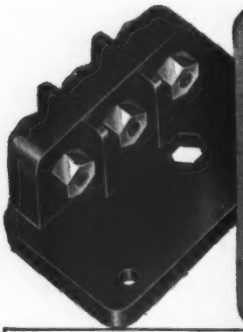
Demy 8vo. Illustrated

"An excellent contribution to the plastics literature."
CHEMICAL AND ENGINEERING NEWS

30s. net from Booksellers, or by post from the Publishers (postage 1s. 2d.).

TEMPLE PRESS LIMITED
Bowling Green Lane, London E.C.1

********* ✳ *********



Quality PLASTIC MOULDINGS with Service

Consult **SOUPLEX Limited**
WESTGATE · MORECAMBE · Phone 1717/8/9

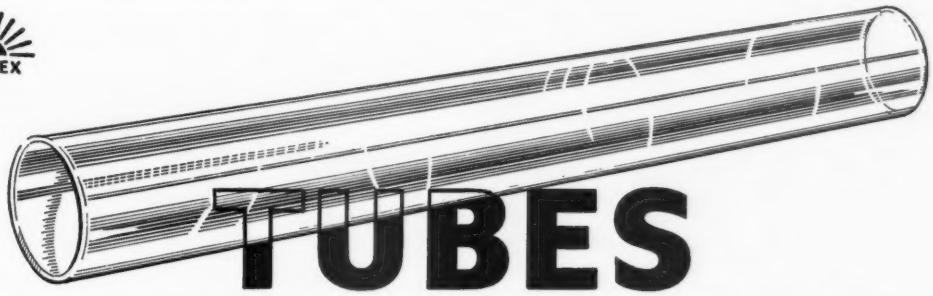
Wanted STOCKS for CASH

We are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus and Redundant Stocks. BOTTLES, Jars, Screw Caps, Cartons, and other Packaging Materials. In fact, goods of all kinds can be disposed of through us without delay, on the most favourable terms, and without trouble.

Should you have anything for disposal either now or at any future time please send us samples, full particulars and price on a cash settlement basis and the matter will have our immediate and careful attention.

RELIANCE TRADING CO.
75, FAIRFAX ROAD, SWISS COTTAGE, LONDON, N.W.6
Phone: KILburn 0581 & 0038 *Grams:* "GORDON" KILBURN 0581

SUNTEX



TUBES

CAST · CLEAR ACRYLIC · SEAMLESS

A wide range of Acrylic Tubing is being produced at our Iver factory—from 2 in. O.D. to 6 in. O.D. in various wall thicknesses. Extruded tube is also available from ¼ in. O.D. to 1¾ in. O.D.

The standard of quality is notably high and the prices interesting.

MOULDINGS AND FABRICATIONS IN "PERSPEX", RIGID P.V.C.

We specialize in high quality workmanship for—Aircraft Vision Panels and Fittings · Industrial, Showroom and Street Lighting Reflectors and Diffusers · TV Masks · Scooter Screens · Museum Jars Caravan Roof Panels, Washbasins/Drainers, etc. . . .

SUNTEX SAFETY GLASS INDUSTRIES LTD.

THORNEY LANE · IVER · BUCKS
AND MOON AIRCRAFT LTD. · BOX · WILTS

TELEPHONES: UXBRIDGE 4970 and IVER 11/12
TELEPHONE: BOX 488

DRM

DURHAM CHEMICALS PRODUCED AT BIRTLEY, COUNTY DURHAM

P.V.C. STABILISERS

Metal Stearates, Laurates, Ricinoleates, Lead Silicate

BRANCH OFFICES:

31 King St. West, MANCHESTER 3
Deansgate 5561

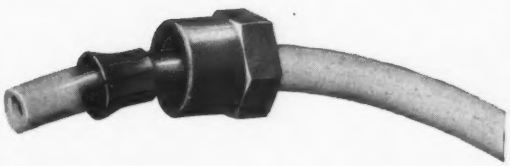
Birtley, COUNTY DURHAM
Birtley 240

180 Hope Street, GLASGOW C2
Douglas 2561

HEAD OFFICE:

DURHAM RAW MATERIALS LTD.
1/4 GT. TOWER ST., LONDON, E.C.3
MANsion House 4333

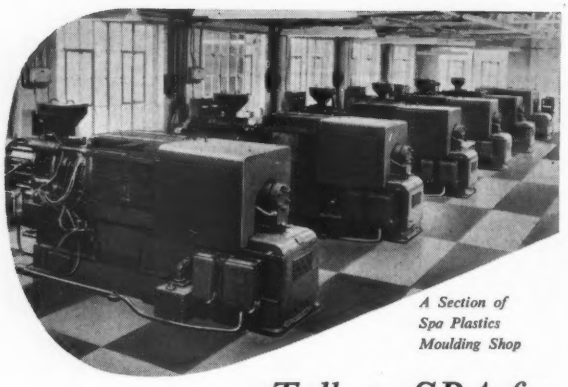
"GYP"



"Gyp" patented couplings provide the most simple and effective means of making joints in plasticised P.V.C. pipes. The joint can be easily made, broken down and remade countless times without collapsing or cutting the pipe in any way. The patent "Gyp" split collar prevents damage to the pipe at all times. Couplings can be used for joining plastic pipes or plastic to metal pipes.

TYPE: Straight, bulkhead, male and female coupling, elbow, tee and banjo.
MATERIAL: Brass, mild steel, light alloy.
WORKING PRESSURE: Up to 60 lb. per sq. in.

HIGH-PRESSURE COMPONENTS LIMITED
'SUNFLEX WORKS' · WEST DRAYTON · MIDDLESEX
Telephone: West Drayton 2226-7-8 Telegrams: GYPONENT, West Drayton



A Section of Spa Plastics Moulding Shop

Talk to SPA for Injection Moulding 2oz. to 32oz.

- Modern Plant.
- 24 Hour Production.
- Capacity for high quality Injection Mouldings in Nylon, Polythene, Cellulose Acetate, Polystyrene and Diakon.
- Utilise our long experience.

SPA PLASTICS (Division of Spa Brushes Ltd.)
Chesham, Buckinghamshire.
Telephone : Chesham 81200 (4 lines)

Are you buying these

STEARINES with close melting point ranges ?

If you are not, may we send you a testing sample ? You will then appreciate the true texture and high quality of Haigh's Stearines and will be able to test for yourself the accuracy of their melting points. Let us have details of your production needs and we will be pleased to submit samples and prices.

HAIGH FOR A1 QUALITY

JOHN HAIGH & COMPANY LIMITED
CLAYFIELD OILWORKS . SLAITHWAITE . YORKS
Telephone: SLAITHWAITE 266-267 ESTABLISHED 70 YEARS
JH/S6

Plastic Scrap

BUYERS
MICHAEL S. STEVENS LTD

Do not let your Scrap Plastics pile up and use up valuable storage space—convert it into money by ringing Michael S. Stevens Ltd. who specialize in Works Collection of Injection Scrap, Scrap cuttings, etc.

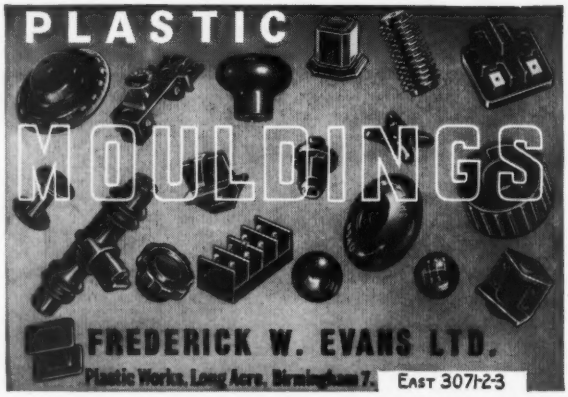
VANDYKE 3345-6

MICHAEL S. STEVENS LTD.
Keswick Rd., London, SW15

ELMBRIDGE INSTRUMENTS LTD

MANUFACTURERS & DESIGNERS
PRESS TOOLS · JIGS & FIXTURES
COMPRESSION & INJECTION MOULDS
JIG BORING TO THE TRADE

ALPHA ROAD · SURBITON · SURREY
Telephone: Elmbridge 9188



British Insulated Callender's Cables Ltd.

★

The Company is establishing a Cable Accessories Development Section within the Thermoplastic Cables Division at Helsby, near Chester. The Section will cover a range of accessories for plastic cables (including radio-frequency types) and will be responsible for the further development of the Company's well-known Polypole Couplers, where the field is rapidly expanding.

★

Applications are invited from suitably qualified men for the post of Section Head. This requires an experienced design engineer, age 28/40, preferably familiar with polythene and/or epoxy moulding techniques. The successful applicant will be responsible to the Divisional Technical Manager for design and laboratory facilities and a small model shop. An attractive salary will be offered and housing assistance will be considered if required.

★

Please submit applications, quoting age, qualifications and experience to the Works Personnel Officer,

BRITISH INSULATED CALLENDER'S CABLES LTD.,
HELSBY, CHESHIRE

for high speed mixing and blending

trough-type mixers are unsurpassed in performance particularly when equipped with the good features of Pascall powder mixers. These mixers are fitted with specially designed spiral mixing blades which produce a rapid blend of the materials.

The contra-flow action of the mixing blades not only ensures a perfect blend of the mixing, but also allows automatic discharge of the mixing when completed. The blades are also removable, a feature that facilitates cleaning the mixers.

Available in six sizes with trough-mixing capacities from 2 to 20 cu. ft., either fabricated from mild steel or stainless steel and also from mild steel with non-contaminating linings.

PASCALL

Write or telephone Crawley 25166 for List BM 3904.

THE PASCALL ENGINEERING CO LTD
GATWICK ROAD · CRAWLEY · SUSSEX

A complete system available for heat, light and dielectric requirements.

Stabilisers for P.V.C.

* **Basic Lead Carbonate** —specially prepared for P.V.C. Supplied only as dispersed paste with Plasticisers to choice.

Dibasic Lead Phosphite
Tribasic Lead Sulphate

PIGMENTING TYPES

Lead Silicate
Dibasic Lead Stearate
Lead Stearate
Cadmium Stearate
Calcium Stearate
Barium Stearate
Lithium Stearate

TRANSLUCENT TYPES

** With the exception of Basic Lead Carbonate (which is supplied only as dispersed paste) all the above products can be supplied dry or dispersed in plasticisers.*

ASSOCIATED LEAD
MANUFACTURERS LIMITED
SPECIAL CHEMICALS DIVISION, CRESCENT HOUSE, NEWCASTLE UPON TYNE, 1, ENGLAND.

Have you a TUBE PROBLEM?

—if so, let us solve it

As a user of tubes—metal or otherwise—just consider whether or not a PAPER tube will do the job. Our paper tubes, **made of special quality paper, are impregnated with Thermo-hardening resins.** Strong, light in weight, they show a definite economy in cost. Used increasingly with every satisfaction in many industries. It will pay you to investigate this. Write to:

THE TEXTILE PAPER TUBE CO. LIMITED

OAKWOOD MILLS · ROMILEY · NR. STOCKPORT

Telephone: Woodley 2271-4

We Buy and Sell all types of

PLASTIC SCRAP

We welcome enquiries to grind customers' own material

Acetate
Butyrate
Nylon
Polyethylene

J. W. NASH & CO., LTD.

27 BEETHOVEN STREET, LONDON, W.10

Telegrams: NASPEX, NOTTARCH, LONDON
Telephone: LADBROKE 4655-6-7

Acrylics
Celluloid
Polystyrene
P.V.C.

SHELL

SHELL CHEMICAL COMPANY LIMITED

Applications are invited for a vacancy in their London office for a

PLASTICS AND RESINS TECHNOLOGIST

experienced in the manufacture of plastics such as styrene polymers, polyethylene and polyvinylchloride. Applicants should be aged between 30–40 years and possess a University Degree in Chemistry or the equivalent professional qualification.

Commencing salary according to age, qualifications and experience. Contributory Pension Scheme: Educational Endowment Scheme. Facilities available for assistance in house purchase. Candidates invited for interview will be reimbursed for reasonable travelling expenses.

Applications to;

SHELL CHEMICAL COMPANY LIMITED,
P.O. Box 83, Shell Court, White Kennett Street, London, E.1.

WHITE LEAD stabilisers

Consult
THE MERSEY
WHITE LEAD CO. LTD.
Sankey Bridges, Warrington
Telephone: Warrington 58

for your P.V.C. compounds

Plastics Classified Advertisements

PRESS DAY.—Classified advertisements for the May issue must be received at Head Office by first post Tuesday, April 23.

Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES.—6d. per word (minimum 12 words 6/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting 2 gns. per single column inch. Series discounts of 5% for 6, and 10% for 12 consecutive insertions allowed to trade advertisers.

TERMS.—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES.—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "Plastics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors although every care is taken to avoid mistakes.

BOX NUMBERS.—Private advertisers desiring to have replies sent care of "Plastics" may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. To avoid mistakes in forwarding, Box numbers should be carefully and legibly copied and replies sent to Box P000, care of "Plastics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM.—Facilities are available to readers to purchase advertised goods on approval by depositing the purchase price with "Plastics." Full details on application. Commission 1% (minimum 2/-) on amount deposited.

HEAD OFFICES.—Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, London Telex," Telex: 2-3039.

BRANCH OFFICES: 7, John Bright Street, Birmingham, 1. Telephone: Midland 4117-8. 50, Hertford Street, Coventry. Telephone: Coventry 62464. 1, Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12, Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AUCTIONS

ESTABLISHED 1855.
EDWARD RUSHTON, SON AND KENYON,
INDUSTRIAL VALUERS, AUCTIONEERS AND
FIRE LOSS ASSESSORS.
12 YORK STREET,
MANCHESTER, 2.
Phone, Central 1937-8.
Grams, Russonken, Manchester. zzz-0304

BUSINESS OPPORTUNITIES

UNCLES, BLISS & CO., LTD., suppliers of a large range of control knobs to Industry are anxious to augment their existing styles. Manufacturers possessing stock tools are requested to forward samples together with any relevant literature. Replies should be addressed to:—Mr. J. Bliss, Uncles, Bliss & Co., Ltd., New Parade, Cherry Orchard Rd., East Croydon. 235-17

WANTED TO PURCHASE.

THE MARLEY TILE COMPANY, LIMITED,

IS INTERESTED IN PURCHASING

A BUSINESS WITH GOOD MANUFACTURING

FACILITIES OF PLASTICS PRODUCTS.

MUST HAVE POSSIBILITIES FOR EXPANSION.

COMMUNICATE IN CONFIDENCE TO:—

THE MANAGING DIRECTOR,

THE MARLEY TILE COMPANY, LIMITED,

RIVERHEAD,

SEVENOAKS, KENT.

239-5324

KLINK PLASTICS ICE CUBES, goodwill, mould, etc., £200. Euco Tools Ltd., 44 London Rd., Kingston, Surrey. 235-x4980

CONSULTANTS

THE INDUSTRIAL DESIGNER'S JOB is to help to improve the appearance and function of your products from the customer's viewpoint. His study of public taste and market trends, economical methods of production and assembly can save money and increase sales. W. Bruce Brown, M.S.I.A., F.R.S.A., 140 Roding Rd., Loughton, Essex. Phone Loughton 1438. 235-05277

DESIGN AND DRAWING

DESIGN AND DRAUGHTING SERVICES. We specialize in particular, in Moulds for Plastics, Compression, Transfer and Injection, also jigs and fixtures. We offer a reliable, speedy and confidential service. Spotona Ltd., Watchett Works, Oakhurst Rd., Southend-on-Sea, Essex. 222-115

MACHINERY, TOOLS AND PLANT

HYDRAULIC. Frazer mono-radial pumps, new and secondhand, in stock. Thompson & Son (Millwall), Ltd., Cuba Street, London, E.14. East 1844. zzz-119

PLASTICS MACHINERY
Hydraulic Presses of all sizes. Injection Machines. Extruders. Mixing Mills. Hydraulic Pumps and Accumulators.
Send your requirements to the specialists.
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
CUBA STREET, MILLWALL, E.14.
Phone, East 4081 (five lines). 235-11

INJECTION NOZZLES. For all machines. Prompt delivery including specials. Euco Tools, 44 London Rd., Kingston, Surrey. 222-125

TWO hand Injection Moulding Machines for sale. £100 the two. Quick sale. Midland. Box P346, care of "Plastics." 236-5321

COMPRESSOR SETS.
600 c.f.m. Broom & Wade Compressor, 100 p.s.i., with 135 h.p. Brook Motor, 400/440/3/50.
400 c.f.m. Broom & Wade Compressor, 100 p.s.i., with 90 h.p. Brook Motor, 400/440/3/50.
330 c.f.m. Broom & Wade Compressor, 100 p.s.i., with 75 h.p. Brook Motor, 400/440/3/50.
Two 310 c.f.m. Worthington Simpson Compressors, 100 p.s.i., with 80 h.p. Crompton Parkinson Motors, 400/3/50. (Max. W.P. 150 p.s.i.)
GEORGE COHEN, SONS & CO., LTD.,
WOOD LANE, LONDON, W.12.
Phone: Shepherds Bush 2070
AND
STANNINGLEY, NR. LEEDS.
Phone: Pudsey 2241. 235-14

POWER PRESS by F. J. Edwards for sale. Little used and in good condition; 8 ton. Adjustable stroke ⅛ in. to 2 in. Adjustable height, table size 16 in. × 12 in. Powered by Brooks 1½ h.p. motor. 400/440/3-phase. Stewart Plastics Ltd., Purley Way, Croydon, Surrey. 235-16

ONE Reed Prentice 4 oz. Injection Moulding Machine, Serial No. 5A/D13/F2588/49 for sale. First-class condition, can be seen working at Portsmouth. Apply to Box P355, c/o "Plastics." 236-5355

FOR SALE.—Lancastrian 250-ton Transfer Moulding Press by Foster, Yates & Thom. Platen size 23 in. × 26 in., 18 in. stroke, Towler Pump, Tem-Con. Safety Guards, etc. In good working condition, five years old. Must be cleared. £600. Fields, Forest Edge, Ringwood Rd., Ferndown, Dorset. Phone, Ferndown 837. 235-x5754

MACHINERY, TOOLS AND PLANT WANTED

EXTRUDER AND VACUUM FORMING MACHINES wanted—send full details, Box P329, care of "Plastics." 237-5242

WANTED 3 oz. Injection Moulding Machine, good condition Windsor if possible, also redundant toy moulds. Full particulars Box P3417, care of "Plastics." 235-x4859

WANTED 16 oz. or larger Injection Moulding machine. State make, condition, age and price. Box P3510, care of "Plastics." 235-20

MISCELLANEOUS

ELECTRICAL HEATING. All types of electrical elements supplied. Apparatus repaired. Heaters designed. G. H. Taylor & Co., Meadow Rd., Netherfield, Notts. 236-5319

MOULDS

COMPRESSION MOULDS available for export, for production of Ashtrays, Cigarette Boxes, Household Articles, Fancy Goods, etc. Box P318, care of "Plastics." 237-05209

MOULDS WANTED

MOULDS WANTED. Send details of your surplus or redundant Injection and Compression Moulds. Box P3210, care of "Plastics." 237-5243

PRODUCTION CAPACITY AVAILABLE

INJECTION MOULDINGS AND PLASTIC COVERING IN ACETATE ALKATHENE, P.V.C. POLYSTYRENE AND DIAKON.
Machined Parts in Brass, Steel and Plastics.
We solicit your inquiries.
F. A. KETCH AND SON, LTD.,
TRENT VALLEY WORKS,
LICHFIELD, STAFFS.
Phone 3591 and 3592. zzz-500

SHORT RUNS A SPECIALITY, LONG RUNS A PLEASURE. Low mould cost and overheads. Injection capacity and technical knowledge at your service. Westminster Plastics, Temple Works, 41 Old Church Rd., Chingford, E.4. Silverthorn 7927. 235-1207

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Temple St., Rugby. Phone 4059. 235-1208

VACUUM FORMED PLASTICS. Facilities for design development, fabricating and printing. B. T. Bennett & Co., 449 Alexandra Avenue, Harrow, Middx. Field End 6755. 236-1219

Production Capacity Available (contd.)

DINES PRODUCTS, Whitehall Lane, Grays, Essex, for injection mouldings. 235-1209

PLASTICS (MANCHESTER), LTD.,
BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND ENGRAVING.
11 WHITWORTH STREET, MANCHESTER, 1.
Central 7081-2 and Central 1000. zzz-308

NYLON, POLYSTYRENE AND ACETATE INJECTION MOULDINGS up to 2 oz. Reliable service. Latest-type machines. Keen co-operation on new lines. W. H. Adamson Plastics, Ltd., 39 Hedley St., Maidstone. 238-5278

VISIJAR LABORATORIES, LTD.
THE LEADING CRAFTSMEN IN "PERSPEX."
PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS "PERSPEX."
SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF "FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 8228 (two lines) zzz-133

INJECTION MOULDINGS by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 244-5276

TUBE LAMINATION AND ENGINEERING, LTD.
HIGH WYCOMBE,
BUCKS.
MAKERS OF S.R.B.P. TUBE "LAMTUF."
LIGHT ENGINEERS.
HIGH WYCOMBE 1921-2 zzz-312

---

16 TO 32 OZ. Injection Moulding Capacity available. Contact Mr. Henry Freeman, Spa Plastics, Chesham 81200. 237-5353

RAW MATERIAL

FOR DISPOSAL: 5 tons Brand New Ebonite and Casein Tubes and Rods, sizes .2 up to .6 diameter. Various colours. Apply Box P2614, care of "Plastics." 235-8

ALWAYS LARGE STOCKS OF
CASEIN
RODS, TUBES AND SHEETS.
PERSPEX
SHEETS UP TO 1 IN. THICK.
CELLULOSE ACETATE
CATALIN RODS.
S.R. (PLASTICS), LTD.,
93 ALDERSGATE STREET, E.C.1.
Phone, Monarch 4686. 245-5323

RIGID P.V.C. SCRAP (White Welvic) in ground and scrap form for disposal in large quantities. Herbert Connor Ltd., 120 Beaufort Park, London, N.W.11 235-31

CLEAR P.V.C. TUBING SCRAP for disposal in regular quantities. Herbert Connor Ltd., 120 Beaufort Park, London, N.W.11. 235-30

FOR DISPOSAL: 2 tons Virgin Khaki and 3 tons Virgin Maroon Polystyrene Pellets. Apply Box P2613, care of "Plastics." 235-9

SATIN FINISH P.V.C. .004, Pastel and Metallic Colours. 360 lb. available ex stock 3s. 6d. lb. or best offer. Box P3515, care of "Plastics." 235-21

Raw Material (contd.)

CUEX, LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose acetate.
Polyethylene.
P.V.C.
Polyvinyl butyral.
Perspex and Diakon.
Send now for details.
Cuex, Ltd., 270 Corporation St., Birmingham. Central 5474. 235-10

POLYTHENE AND POLYSTYRENE LUMPS in large quantities for disposal. Send top offers to Box P3516, care of "Plastics." 235-27

RAW MATERIAL WANTED

SURPLUS STOCKS of thermosetting and thermoplastic moulding powders wanted. Send details. Box P311, care of "Plastics." zzz-227

ERLANOS, LTD., 93 Aldersgate St., E.C. (Monarch 4686), require Perspex and cellulose offcuts and scrap, clear and coloured; highest prices paid. 241-5177

WANTED, Polythene scrap. Write to Box P221, care of "Plastics." zzz-132

PROMPT CASH OFFERED for virgin and reprocessed cellulose acetate and polystyrene. Give manufacturer's name and backing. Box P312, care of "Plastics." zzz-131

P.V.C. GARMENT AND HANDBAG OFFCUTS wanted. We collect and pay cash. Brockwell Plastics, Ltd., 50 Hollingbourne Rd., S.E.24. zzz-130

NYLON SCRAP—regular buyers. Michael S. Stevens Ltd., Keswick Rd., Putney, S.W.15. Vandyke 3345. 235-13

SPOT CASH BUYERS of all thermoplastic injection scrap and redundant virgin lots. Regular collections. WG Plastics, 14 Cambridge Park Mews, Twickenham, Middlesex. Popesgrove 1800. 246-5352

POLYSTYRENE, POLYTHENE AND C/A SCRAP wanted. Good prices paid. Any quantities. Box P3514, care of "Plastics." 235-22

TOP PRICES PAID FOR POLYTHENE SCRAP, FILM OR LUMPS. Herbert Connor Ltd., 120 Beaufort Park, London, N.W.11. 235-32

POLYTHENE FILM AND BAG WASTE urgently required. Highest prices paid. Box P3518, care of "Plastics." 235-29

POUND NOTES for any quantity of polythene and perspex scrap. Box P3517, care of "Plastics." 235-28

POLYTHENE, POLYSTYRENE, DIAKON, P.V.C., ACETATE SCRAP wanted, in lump, scrap, film, sheet or reground form continuously. Please send samples and details to Herbert Connor Ltd., 120 Beaufort Park, London, N.W.11. 235-33

WANTED. CLEAN RE-CLAIMED POLYTHENE. All types and colours. Offers to Box P3313. 236-5357

WE REQUIRE large regular supplies of Nylon Scrap, Shavings, Lumps and Rejects. Box P332, care of "Plastics." 235-25

THERMO PLASTICS SCRAP. We always buy large and small quantities and pay prompt Cash. Send offers to J. W. Nash & Co. Ltd., 27 Beethoven St., W.10. Ladbroke 4655/6/7. 235-26

PLASTICS MOULD DESIGN: Injection, Compression, Transfer. Competitive charges and deliveries. Product design and styling. Also Jigs, Tools, Fixtures, etc. D. & H. Designs Ltd., 265, Finchley Rd., London, N.W.3. HAMpstead 6656. zzz-136

SITUATIONS VACANT

DESIGNER-DRAUGHTSMAN required, must have experience of Compression, Injection and Transfer Mould Tools. Permanent and progressive position with small firm 30 miles from London. Golden opportunity for one with the necessary qualifications. Send full details of experience and salary required. Box P3223, care of "Plastics." 237-5245

Situations Vacant (contd.)

FOREMAN REQUIRED for small compression moulding shop approximately 30 miles from London. Must be fully experienced. Permanent position. Write Box P339, care of "Plastics." 235-5275

ASSISTANT EXPORT MANAGER required to develop industrial rubber division of leading manufacturer. Rubber technology background important but not essential. Successful applicant will be based out of London, possibly in West Country and will be required to travel overseas. Write stating age, experience, qualifications and present salary to Box P343, care of "Plastics." 235-5322

SALES ENGINEER REQUIRED.—Must have a background of the complete field of Extrusion Engineering, embracing blown tubing, sheet, cable covering and piping, and, of course, the ability to sell. Good salary for the right man. Write in confidence giving full details of previous experience, etc., to N. Browne, Bone Brothers Ltd., Manor Farm Rd., Alperton, Wembley. 236-5320

TECHNICAL SALES ASSISTANT required by Plastics Raw Material Manufacturers in South London area. Applicants should have experience in similar or allied industry and some experience in customer contact. This is a progressive and pensionable appointment with expanding company. Applications in writing in first instance stating age, qualifications and experience to Box P359, care of "Plastics." 235-1

MOULD DESIGNER/ENGINEER required in Cardiff area, to take charge of plastics mould design office, estimate mould costs, and handle interesting technical problems. Sound technical education required with wide practical experience in injection and/or die casting mould design. Full details to Box P358, care of "Plastics." 235-2

GENERAL MANAGER required by progressive Injection Moulding Company near Cardiff now employing over 200. This is a top level appointment and calls for a man of outstanding ability: he should preferably have a Plastics and Engineering background with wide administrative experience (including Trade Union practice). Please reply to Secretary, Box P357, care of "Plastics." 235-3

A VACANCY occurs for Injection Moulding Department foreman in North London. Good salary. Excellent conditions. Progressive position for experienced man. Apply Box P353, care of "Plastics." 235-4

TECHNICAL ASSISTANT required by a large expanding industrial concern in the Wigan area for their new plastics department. The department manufactures plastic laminates and glass polyester products. Duties will include process control work and the supervision of experimental runs. Applicants should a Diploma of the Plastics Institute or an ordinary National Certificate, with suitable experience in plastics. This is a modern factory with excellent welfare, recreation and canteen facilities. There is a pension scheme and the position offers excellent opportunity for advancement. Please apply to Box P352, care of "Plastics," giving details of age, education and experience. 235-5

RESIN TECHNOLOGIST required for control and development of production in Birmingham factory. Experience essential in synthetic resin control and practical applications. The Company is small at present, but is associated with the Birfield Group, and considerable expansion is expected. Applicants, preferably between ages 25–35, should state age, experience, qualifications and present salary. Box P351, care of "Plastics." 235-6

PLASTICS senior tool design Draughtsman required for modern injection moulding factory. Must have a knowledge of advanced moulding techniques and an ability to supervise drawing office. The position offers scope for advancement and good remuneration. Please apply to the Personnel Officer, The Metal Box Company Limited, Manor Farm Rd., Alperton, Middlesex. 235-7

BRITISH RESIN PRODUCTS LTD.,
HAYES ROAD, SULLY, NEAR PENARTH,
HAVE A VACANCY FOR A FIRST-CLASS TECHNICAL MAN IN THEIR MOULDING POWDER DIVISION. A GRADUATE CHEMIST WOULD BE PREFERRED BUT APPLICATIONS WILL BE CONSIDERED FROM SUITABLE PEOPLE WITH EXPERIENCE OF THERMOSETTING MATERIALS.
PLEASANT SEMI-RURAL LOCATION. GOOD SALARY, NON-CONTRIBUTORY PENSION SCHEME.
State full details, age, experience, positions held, in confidence to Staff Manager. 235-15

Situations Vacant (contd.)

FOREMAN for night shift wanted. Knowledge of maintaining machines preferred (injection moulding). Good wages to right applicant. Box P3115, care of "Plastics." 235-12

PLASTIC MOULDING COMPANY, Wimbledon area, requires the services of a young man to train as an assistant to the Production Manager. Experienced in Injection Moulding and Production Planning. Pension scheme in operation. Salary according to experience. Apply Box P354, care of "Plastics." 236-5356

EXPERIENCED MANAGER wanted to take charge of production in prefabricated polythene and p.v.c. (tank lining, ducting, etc.) Box P.3511, care of "Plastics." 235-5660

FOREMAN required at Slough factory. Practical knowledge of Injection and Compression moulding and able to control labour. Write full particulars, salary required, etc., to Box P356, care of "Plastics." 235-x5384

WANTED ASSISTANT TO PRODUCTION WORKS MANAGER. Excellent opportunity for young man with good knowledge of plastics leaving University or Polytechnic. Written application to: Uni-Tubes Ltd., Alpha St., Slough, Bucks. 235-19

PRODUCTION MANAGER required for injection and compression moulding concern of medium size in North London, versed with all aspects of moulding, particularly Diakon, Nylon and Polystyrene. Applicant must be capable of taking full charge and be conversant with all modern techniques with practical knowledge of Peco and Lester machines.

Pension scheme and assured future with good salary for the right man. Please send full particulars of career and present earnings to Motor & Electronics Corporation Ltd., 31/32 Alfred Place, W.C.1. 235–18

Situations Vacant (contd.)

A vacancy exists in the
PLASTICS DEPARTMENT
of
THE YORKSHIRE COPPER WORKS, LTD.,
LEEDS,
for a man between the ages of 30 and 40.

His chief concern will be to keep abreast of the rapid development which is taking place in this country and abroad in plastic materials. He will be particularly concerned with investigations into new materials and much of his time will be spent in connection with the Laboratory side of plastics manufacture, particularly the testing, including physical test methods, of products.

He will, therefore, require to have a sound knowledge of chemistry, preferably to B.Sc. or A.R.I.C. standard, together with previous experience in the plastics industry.

This will be a permanent appointment qualifying a person for eventual membership of a Pension Scheme and Co-partnership Scheme together with other attractive staff conditions of employment. Assistance with housing and removal expenses can also be considered where necessary.

Applications, giving full details of career, qualifications, and present salary, should be marked "Plastics—Confidential" and addressed to the Personnel Supervisor, Yorkshire Copper Works, Ltd., Leeds, 10. 235–24

APPLICATIONS are invited for the position of Senior Chemist to take charge of development work on thermosetting plastics in medium-sized plastics factory in North-West of England. Candidates should possess a good honours degree or equivalent qualifications. Salary will depend on qualifications, experience and age of applicant. A contributory Pension Scheme is in operation and assistance will be given with accommodation if required. Applications, in strict confidence, to Box P3513, care of "Plastics." 235-23

APPLICATIONS are invited for the position of Assistant Works Manager, North London Area. Approx. 200 employees. Previous practical works experience necessary and knowledge of Hard and Soft Rubber, and Plastics. Age 24–45. Salary about £850/900 p.a. depending upon qualifications. Details of education, experience, etc., to Box M2900, Haddon's, Salisbury Square, London, E.C.4. 236-5354

SITUATIONS WANTED

ENGINEER-DESIGNER-ESTIMATOR with 18 years' experience of injection, compression transfer and laminates, seeks responsible executive post at home or abroad, or in consulting capacity. Box P.3519, care of "Plastics." 235-x5812

WORKS MANAGER with engineering background, 20 years' experience compression and injection moulding, seeks change. Box P3512, care of "Plastics." 235-x5661

TIME RECORDERS

FACTORY TIME RECORDERS. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., Ltd., 157–159 Borough High St., S.E.1. 245-5325

BOOKS AND PUBLICATIONS

MOULDS FOR PLASTICS, by W. M. Halliday. Meets the needs of both mould designer and toolmaker. Discusses design, construction, operation and maintenance and problems in the light of practical experience. Illustrated. 286 pages, 30s. net from booksellers, or 31s. 1d. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

PLASTICS, SCIENTIFIC AND TECHNOLOGICAL (3rd Edition), by H. R. Fleck. A recognized standard work on the chemistry and technology of plastics. Illustrated. 400 pages, 40s. net from booksellers, or 41s. 4d. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

CELLULOSE ACETATE PLASTICS, by Vivian Stannett. A complete technical survey of one of the most popular and adaptable products of the plastics industry Illustrated, 284 pages, 30s. net from booksellers or 31s. 2d. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

THE THEORY OF POLYMERIZATION, by H. R. Fleck. A full explanation in simple language with examples, calculations and exercises of this fundamental aspect of the chemistry of plastics. Illustrated, 144 pages, 10s. 6d. net from booksellers, or 11s. 2d. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

CLASSIFIED ADVERTISEMENT ORDER FORM

Plastics BOWLING GREEN LANE, LONDON, E.C.1

PLEASE INSERT THE FOLLOWING ADVERTISEMENT IN THE NEXT.....ISSUE/S UNDER THE HEADING OF.....

Rate 6d. per word (minimum 12 words 6/-) ● Box Numbers: allow 4 extra words plus 1/- registration fee.

						Min.
						6/-
6/6	7/0	7/6	8/0	8/6	9/0	
9/6	10/0	10/6	11/0	11/6	12/0	
12/6	13/0	13/6	14/0	14/6	15/0	
15/6	16/0	16/6	17/0	17/6	18/0	

★ *Please use BLOCK letters throughout.* *Name and Address if to be used in the advertisement must be included above and paid for.*

PRESS DAY—Classified advertisements for the May issue must be received at Head Office by first post April 23.

REMITTANCE ENCLOSED FOR...../.....

Remittances should be crossed and made payable to TEMPLE PRESS LTD.

NAME: _____

ADDRESS: _____

_____

SIGNATURE: _____

SHELL CHEMICAL COMPANY LIMITED

has vacancies for:

1. TECHNICAL SALES SUPERVISOR

The man required should be aged 25–45, have good personality and drive, plus experience and contacts in the field of expanded plastics and similar insulating materials, both from the technical and sales angles.

2. TECHNICAL SERVICE ASSISTANT

For work in connection with plastics. The man required should be aged 23–35, have good personality and be mobile. He should also have a good knowledge of plastics, especially thermoplastics, and have some training or practical experience of injection moulding and extrusion.

Generous pension scheme and other benefits. Salaries according to age, qualifications and experience.

Write with full details to SHELL CHEMICAL COMPANY, LIMITED, Personnel Department, 170, Piccadilly, London, W.1.

BYSON FOR BAKELITE

Acetate and other Synthetic Mouldings, Modern Plant and Facilities.

APPLIANCE CO. LTD.,
WOOLFOLD, BURY, LANCS

Telephone: Bury 1560–1 Telegrams: "Bysonite, Bury"

INDEX TO ADVERTISERS

Name	Page
A	
Aerospray Associated, Ltd.	94
Albright & Wilson, Ltd.	65
Armstrong Patents Co., Ltd.	94
Artrite Resins, Ltd.	11
Ashdowns, Ltd.	73
Asmidar Plastic Moulding Machines, Ltd.	82
Associated Lead Manufacturers, Ltd.	99
B	
Bakelite, Ltd.	60
Barber & Duffy, Ltd.	95
Beck Koller & Co. (England), Ltd.	3
B.I.P. Chemicals, Ltd.	64
B.I.P. Engineering, Ltd.	5
B.I.P. Tools, Ltd.	67
Birkbys, Ltd.	42
Blackfriars Rotary Cutters, Ltd.	74
Blagden, Victor, & Co.	84
Bradley & Turton, Ltd.	21
Brand, Ed., Ltd.	13
Bridge, David, & Co., Ltd.	56
British Electrical Development Association, The	41
British Ermeto Corporation, Ltd.	93
British Insulated Calender's Cables, Ltd.	99
British Oxygen Co., Ltd., The	54
British Resin Products, Ltd.	36, 37
Burtonwood Engineering Co., Ltd.	1, 14
BX Plastics, Ltd.	Inside Front Cover
BX Plastics, Ltd. (Miltoid Sales Dept.)	84
Byson Appliance Co., Ltd.	104
C	
Castle, John, & Co., Ltd.	94
Cellgrave Co., Ltd.	83
Churchill Instrument Co., Ltd.	92
Cole, R. H., & Co., Ltd.	12
Crystalate, Ltd.	46
D	
Dunbar & Cook, Ltd.	80
Durham Raw Materials, Ltd.	97
E	
Electro-Methods, Ltd.	43
Elliott Brothers (London), Ltd.	66
Elliott, E., Ltd.	45
Elmbridge Instruments, Ltd.	98
Elm Plastics, Ltd.	92
Empire Plastics (Birmingham), Ltd.	94
Erinoid, Ltd.	Front Cover
Ether, Ltd.	18
Euco Tools, Ltd.	96
Evans, Frederick W., Ltd.	98
F	
Fawcett-Finney, Ltd.	26
Ferguson, James, & Sons, Ltd.	33
Fibreglass, Ltd.	27
Fraser & Glass, Ltd.	39
Freeman Taylor Machines, Ltd.	85
Funditor, Ltd.	77
G	
Geigy Co., Ltd., The	44
General Electric Co., Ltd., The	71
General Engineering Co. (Radcliffe), Ltd.	32
Genristo, Ltd.	78
Glass Yarns & Deeside Fabrics, Ltd.	77
Granbull Tool Co., Ltd., The	59
Griffiths, Gilbart, Lloyd & Co., Ltd.	78
Grilon & Plastic Machinery, Ltd.	40
Grist Plastics	49
H	
Haigh, John, & Co., Ltd.	98
Harvey, G. A., & Co. (London), Ltd.	82
Heenan & Froude, Ltd.	91
Hilger & Watts, Ltd.	93
High Pressure Components, Ltd.	97
Holzverzucherungs A.G.	40
Hupfield Plastics, Ltd.	86
I	
Imperial Chemical Industries, Ltd., Plastics Division	23, 38, 53, Inside Back Cover
Industrial Appliances, Ltd.	68, Back Cover
Industrial Plastics, Ltd.	30
Insulation Equipments, Ltd.	7
J	
Jobling, James A., & Co., Ltd.	81
K	
Kayser Ellison & Co., Ltd.	2
Kent Mouldings	80
Kimbell, John, & Co., Ltd.	52
Kleestron, Ltd.	6
L	
Lankro Chemicals, Ltd.	58
Ly-Bak, Ltd.	94
M	
Mandleberg, J., & Co. (Rubber), Ltd.	86
M. & B. Plastics, Ltd.	57
Manesty Machines, Ltd.	91
Marshall, C. & C., Ltd.	76
Melwood Thermoplastics, Ltd.	88
Mersey White Lead Co., Ltd., The	100
Metalin, Ltd.	72
Metropolitan Plastics, Ltd.	17
Microcell, Ltd.	83
Miller, P. & L., Ltd.	75
Monsanto Chemicals, Ltd.	63
N	
Nash, J. W., & Co., Ltd.	100
Nash, William, Ltd.	34
National Plastics (Sales), Ltd.	62
Negri Bossi & Co.	69
Nu-Swift, Ltd.	22
P	
P.A.M., Ltd.	96
Pascall Engineering Co., Ltd., The	99
Peco Machinery Sales (Westminster), Ltd.	10
Pepco, Ltd.	92
Permali, Ltd.	74
Pfizer, Ltd.	19
Phoenix Rubber Co., Ltd.	92
Piece Parts & Assemblies	72
Plant Installations, Ltd.	48
Plastic Engineers, Ltd.	87
Punfield & Barstow (Mouldings), Ltd.	28
R	
Radio Heaters, Ltd.	79
Redifon, Ltd.	95
Reliance Trading Co.	96
Resinoid & Mica Products, Ltd.	90
S	
Sale, H. B., Ltd.	85
Saro Laminated Wood Products, Ltd.	35
Scott Bader & Co., Ltd.	20
Shaw, Francis & Co., Ltd.	24, 25
Shell Chemicals, Ltd.	16, 100, 104
S.I.C. Plastics, Ltd.	4
Simmonds Aerocessories, Ltd.	50
Souplex, Ltd.	96
Spa Plastics	98
Steele & Cowlishaw, Ltd.	87
Sterling Moulding Materials, Ltd.	15
Stevens, Michael S., Ltd.	98
St. Just, Theodore, & Co., Ltd.	90
Streetly Manufacturing Co., Ltd., The	55
Suntex Safety Glass Industries, Ltd.	97
T	
Tarlair, Ltd.	47
Textile Paper Tube Co., Ltd., The	100
Toolchrome, Ltd.	29
Turner Bros. Asbestos Co., Ltd.	31
U	
United Coke & Chemicals Co.	79
Utilex, Ltd.	88
W	
Wallington Weston & Co., Ltd.	51
Warbrick (Engineering Specialties), Ltd.	14
West Instrument, Ltd.	81
Wickman, Ltd.	8, 9
Wiggins, Teape & Alex Pirie (Sales), Ltd.	70
Williams (Hounslow), Ltd.	89
W. S. Electronics (Extruders) Ltd.	76

EDITORIAL AND BUSINESS NOTICES

"PLASTICS" is published on the second Wednesday in each month in London, England by TEMPLE PRESS LIMITED, and is registered for transmission to Canada and Newfoundland by magazine post. Application for second class matter pending at the Post Office, New York, N.Y.

EDITORIAL, ADVERTISEMENT, AND PUBLISHING OFFICES.—Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, London, Telex." Telex: 2-3039.

BRANCH OFFICES.—7 John Bright Street, Birmingham, 1. Telephone: Midland 4117–8. 50 Hertford Street, Coventry. Telephone: Coventry 62464. 1 Brazennose Street, Manchester, 2. Telephone: Deansgate 6114–8. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

EDITORIAL.—All editorial communications and matter must be addressed to the Editor and not to individuals. Drawings or MSS or other material not considered suitable will be returned if stamps are enclosed, but the Editor does not hold himself responsible for the safe keeping or safe return of anything submitted for his consideration. Payment for contributions will be made following publication.

ADVERTISEMENTS.—Whilst every precaution is taken to ensure accurate printing, the publishers will not be responsible for printers' errors, or for errors arising out of telephonic instructions relating to advertisement copy, nor will they be responsible for advertisement blocks destroyed by fire or that are left in their possession for more than one year. Advertisers must in all cases bear the cost of drawings, photographs and/or blocks used in their advertisements. Copy must be supplied without application from the publishers, and current copy and blocks will be repeated if new copy is not received at the time of closing for press. Orders for advertisements are subject to acceptance in writing from the Head Offices. Advertisement copy is subject to the approval of the publishers. All advertisements and contracts are accepted and made upon the express condition that the publishers have the absolute right to refuse to insert copy to which they may object for legal, public or trade reasons, and such refusal of copy shall not be a good ground for advertisers to stop a current contract or to refuse to pay for the same, or for taking action for breach of contract. The advertisers will indemnify the publishers against any damage sustained by them as the result of the inclusion of their advertisements. The publishers, whilst endeavouring to ensure that advertisements shall appear with all possible regularity, will not be held liable for any loss occasioned by the failure of any advertisements to appear from any cause whatever. The acceptance of an order does not confer the right to renew on similar terms. The publishers reserve the right to increase the advertisement rates at any time, or to vary the terms of contract as regards space or frequency of insertion. All orders are accepted on the understanding that any such increase in rate or other amendment may come into immediate operation on all outstanding insertions. In such event, the advertiser has the option of cancelling the balance of contract. Contracts relate to the advertisers' own goods or services, and the space may not be sub-let or disposed of in any way. Conditions which are contained in order forms other than those of the Proprietors and which do not conform to, or are in addition to, the Proprietors' conditions, will not be recognized as binding. Special conditions must be subject to mutual agreement.

SUBSCRIPTIONS AND SUPPLIES.—"Plastics" is obtainable to order from newsagents and bookstalls or by post from the publishers at an annual subscription rate of 36/- (Canada and U.S.A. $5.50), postage included. Shorter periods pro rata. Subscriptions are prepayable.

"Plastics" is obtainable from newsagents and bookstalls abroad through the following agents:—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette et Cie, Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson, Subscription Service Ltd., Toronto, etc.; Cordon & Gotch, Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th St., New York 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 190, Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.

REMITTANCES.—Postal orders, cheques, etc., should be made payable to TEMPLE PRESS LTD.

COMMUNICATIONS.—All orders, letters and inquiries regarding advertisements, subscriptions, and other business matters should be addressed to the Manager, "Plastics," Bowling Green Lane, London, E.C.1.

Published monthly by the Proprietors, TEMPLE PRESS LIMITED, Bowling Green Lane, London, E.C.1, and printed in England by SIR JOSEPH CAUSTON & SONS, LTD., Eastleigh.

Make a name for yourself in 'PERSPEX'

1 South African display sign for K Royal Tyres.

'PERSPEX' ACRYLIC SHEET makes the best signs in any language. It is a very handsome material, extremely tough, light and easy to handle, and will stand up to weather conditions in any part of the world.

The advertising display signs illustrated are Italian, South African and British. 'Perspex' is selling goods all over the world, every minute of the day — and often far into the night. Because 'Perspex' can be transparent, it is ideal for illuminated displays.

'Perspex' is available in clear or opal sheet or in a wide range of transparent, translucent and opaque colours.

2 British 'Perspex' sign for 'Esso' Petrol.

3 Italian illuminated sign for S. Pellegrino orangeade, made of 'Perspex'.

'PERSPEX' *is the registered trade mark for the acrylic sheet manufactured by I.C.I.*

ICI

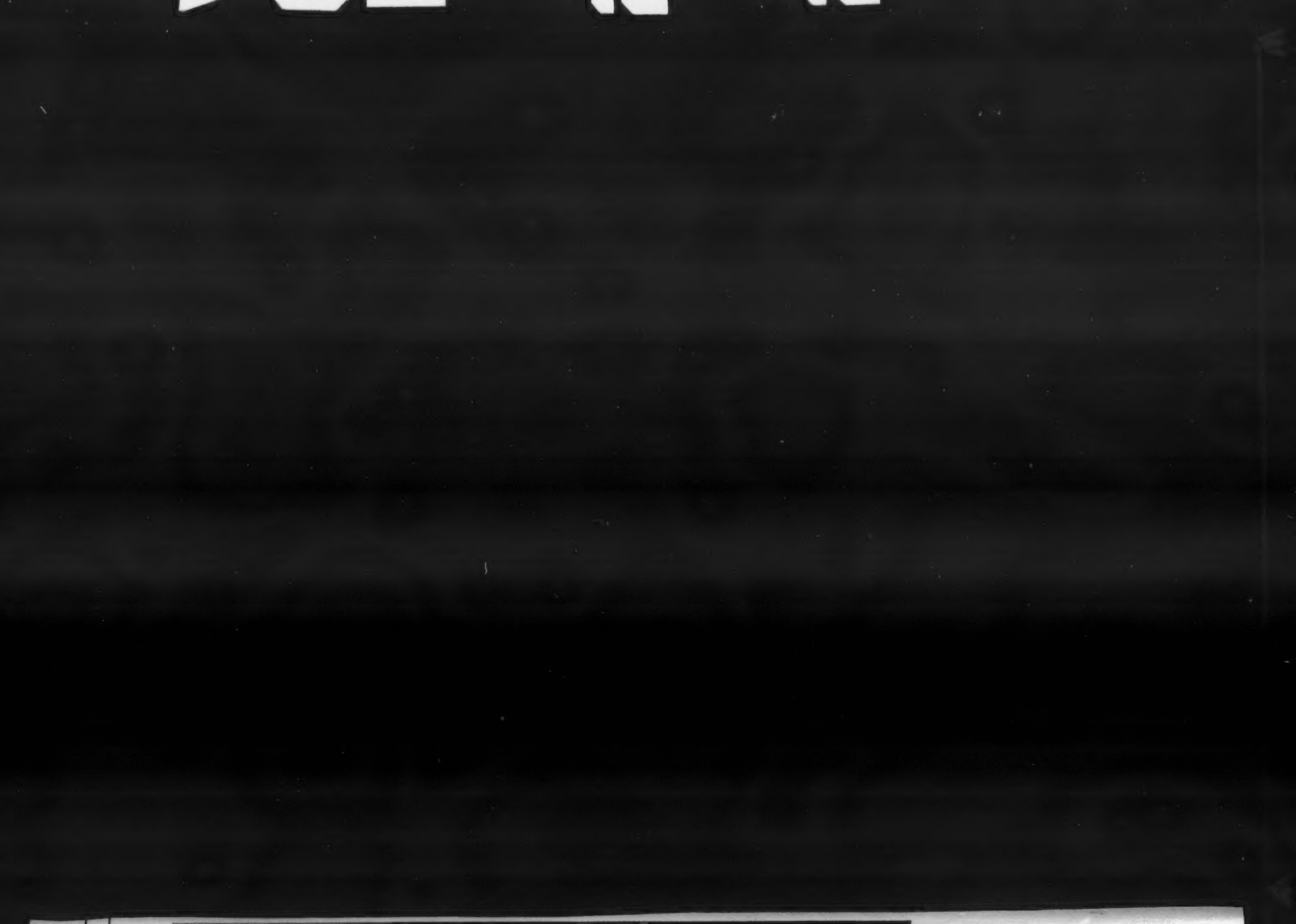
P.627

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

Vol. XXII. No. 235 Plastics APRIL. 1957

The containers of today are unbreakable polythene

Photographed against line drawings of the pitchers and amphoras of the past, we show you the containers of today—in beautiful and practical lightweight unbreakable polythene. These are 'Poly-Tainers' . . . just a few from our immense collection. These particular examples are custom-styled to clients' special requirements. We also hold a very large range of stock moulds in limitless colours, and individual printing can turn out an endless variety of bottles without mould costs. Sizes range from ½ oz. to 15 gallons, and suitable dispenser attachments to spray, drop, puff or pour your product can be supplied. The conventional shapes we can supply from stock . . . individually designed bottles take just a little longer.

unbreakable polythene containers **Poly-Tainer**

Enquiries to INDUSTRIAL APPLIANCES LTD., 21/22J Grosvenor Street, London, W.1. Tel. GROsvenor 5976/8 (P.B.X.)
Manufactured by E. Shipton & Co. Ltd. Ferndown Works, Northwood Hills, Middx. Tel. PINner 1103/5 (P.B.X.)